

# America's Network

FEBRUARY 15, 1998

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## BURSTING at the SEAMS: Wireless providers drench a data-parched market.

Also inside:

- Return on wireless investment defined
- PCS marketing: pulling out all the stops
- Smart antennas optimize CDMA networks





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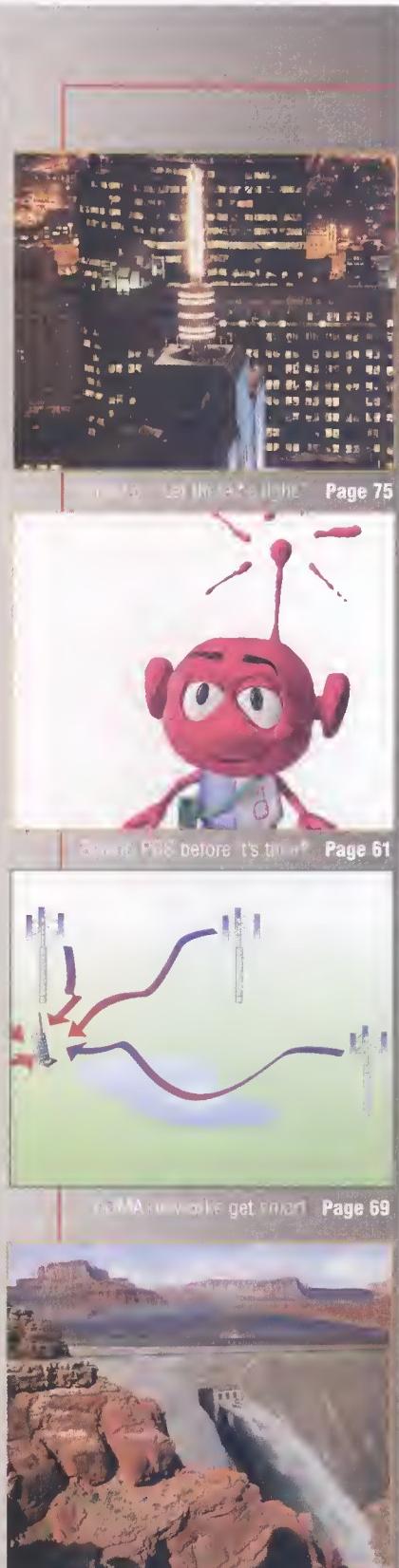
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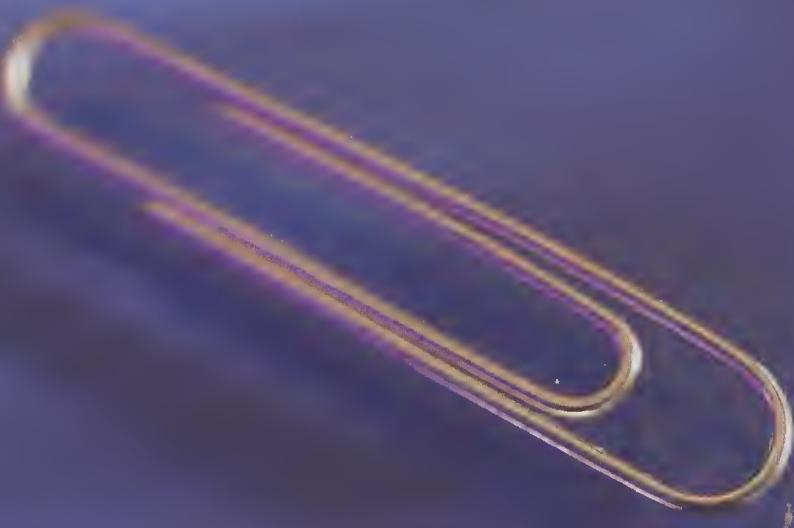
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Cover: Let it rain. Wireless providers open the flood gates on a data-parched market. Cover photo composite by Jon Fraze

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**JONATHAN KAPLAN**

# 'Vested' relations

## Capture the data, capture the wireless customer.

**C**onventional wisdom says the best strategy for reducing customer churn among digital wireless carriers is to compete in terms of bigger coverage areas and smaller service costs. Today's two-pronged approach seems sensible on the surface as new competitors seek to establish themselves.

However, these carriers are unwittingly setting themselves up for customer backlash later, when the climate for wireless inevitably changes. Coverage won't carry much weight as a selling point once new infrastructures are in place and roaming agreements assure coast-to-coast communications. Then, the threat of churn will loom even heavier from customers trained to shop solely on price differentiation.

What can carriers do to insulate themselves from the backfire that is likely to result from today's nearsighted market focus? They must add a third strategy to create differentiation and build customer relationships now, so that they don't become just the telecom pipeline.

### CAPITALIZING ON DATA OFFERINGS

Wireless data services and brand loyalty are most effective for deepening and sustaining customer relationships. Wireless users demand data services in the form of paging, e-mail and faxing. Newer, more powerful digital handsets are accommodating these needs, replacing the desktop. The new handsets also are creating ways to access the Internet and other content-specific information services such as news, sports, stock quotes, travel and entertainment channels.

By capitalizing on emerging enhanced handsets and offering personalized end-user services, wireless carriers can develop a more personal, long-standing relationship with their customers. When combined with established brand equity, these relationships instill customer loyalty, which can weigh as heavily in the decision-making process as coverage and price. Studies show that the more services customers use from a wireless provider, the less likely they are to leave for another carrier.

Familiarity and convenience are common reasons customers tend to stay with a carrier that offers enhanced services. Once customers learn how to use these services and establish a comfort zone, switching carriers to save a few pennies is not worth

**Once customers have a comfort zone, switching carriers to save a few pennies is not worth going through a new learning curve.**

going through a new learning curve. From the carrier standpoint, data services provide opportunities to create brand identity that simply is not possible through voice-only services. Also, it opens avenues for strategic, cooperative marketing partnerships with new products and services that normally wouldn't be associated with wireless telecom. For example, a wireless carrier could provide a service that relays hourly news updates. When the information downloads to the phone, the customer sees branding messages from the carrier as well as the news service. These kinds of services also let carriers track customer usage and habits, which creates even more targeted services and additional leverage in building relations.

Carriers might hesitate to consider wireless data services because they represent an unproven, still-emerging market. Some carriers are concerned that they might invest the resources necessary to create data services, only to find they reach limited customer needs. Carriers can identify and develop services with accuracy by conducting appropriate research and market trials. Carriers also should look to companies that provide set services, which the carriers can repackage and offer to their customers.

### MAKE IT HARD TO LEAVE

Data services help customers to become more vested in their relationship with their carrier. A wireless carrier in Finland offers a data backup service that allows carriers to transfer and update critical information residing on their digital phones to a secure, remote-storage server. Customers who switch to another carrier not only lose their subscriptions to the service, but also lose the time and effort invested in developing this secure information-storage service.

Jonathan Kaplan is vice president and publisher of Wireless and Content Services Group at Geoworks (Alameda, Calif.).

Network deployment and pricing are important to the consumer; however, future success stories will center around brand awareness and wireless services.

Carriers must focus on the three Cs of marketing their wireless company: coverage, cost and customer relationships. ■

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**SUSAN BAHR**

# The dynamic duo MDS, ITFS enter datacomm arena.

**M**ultipoint distribution service (MDS) and its educational counterpart, instructional television fixed service (ITFS), are entering the data communications business. MDS/ITFS licensees can provide one-way data transmissions, but that soon could change if the FCC adopts its proposal to permit two-way transmissions. Two-way data (read: Internet access) could increase MDS/ITFS penetration by providing transmission rates far exceeding those available over copper wire.

MDS and ITFS use neighboring frequencies in the 2-3 GHz range. MDS has been used to provide wireless cable services. Without the expense of laying cable and without having to amplify the signal between a cable TV (CATV) head-end and the subscriber, MDS can be less expensive than traditional CATV. ITFS is used by K-12 schools and higher education institutions to provide primarily video services, such as distance learning. Cost has been a key factor in limiting the penetration of ITFS; however, some ITFS licensees have solved this problem by leasing excess capacity to MDS operators. In turn, MDS operators often provide equipment and revenues that are used to support ITFS.

## SYMMETRICAL SPEEDS

The FCC proposes to permit MDS and ITFS licensees to provide two-way transmissions. Currently, MDS and ITFS may provide downstream Internet access, but must use wireline telephone service for comparatively slower, upstream transmissions. The commission would allow MDS and ITFS licensees to replace the wireline upstream component with wireless MDS and ITFS—making the downstream and upstream transmission speeds more symmetrical. Data speeds could reach 10 Mbps or higher.

With this capability, telecommuters using MDS may be able to transfer files to and from their corporate networks at speeds many times faster than ISDN and T1. Students could use ITFS to access campus networks. An open question is whether Internet use will count toward the minimum weekly hours of educational programming the FCC requires for ITFS licensees.

**MDS/ITFS networks may need to be redesigned into cellularized networks to facilitate upstream responses and frequency reuse.**

ways to recoup these additional costs—for example, by leasing more excess capacity to MDS operators.

## CONVERGENCE IS HAPPENING

If the FCC permits two-way Internet access on MDS and ITFS, telephone service will not be far behind. Students using Internet access via ITFS to make long distance calls make less use of wireline long distance services. Universities that resell long distance services to their students and use those revenues to fund other voice, data and video services may need to recover lost revenues from taxpayers or the students.

Perhaps, in the future, two-way MDS/ITFS transmissions with symmetrical data rates combined with cellularized networks may provide the technological basis for voice offerings without depending on the Internet. Voice services may be necessitated by competition from the new local multipoint distribution services which can be used for voice and Internet access. Local exchange carriers (LECs) may see MDS as an efficient way to provide high-speed Internet access in remote locations; less plant and fewer failure points than a wireline system would make trouble spots easier to diagnose and repair.

LECs that already provide their own Internet access also may want to team with ITFS licensees to help establish Internet access services for educational institutions (federal universal service support may be available).

While the industry has focused on the yet-to-be-realized convergence of CATV and wireline telephony, convergence, indeed, is already happening on MDS and ITFS. ■

**Susan Bahr is a telecommunications attorney in Washington (sbahr@aol.com). Article does not constitute legal advice; persons seeking legal guidance for specific situations should seek direct counsel.**

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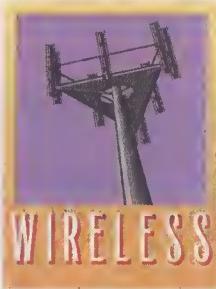
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CHUCK MURPHY

# The return factor

The Return on Investment approach is a consistent, logical, objective tool for considering wireless buildouts.

**T**

O SAY THAT THE WIRELESS INDUSTRY IS MOTIVATED BY A SENSE OF URGENCY IS AN UNDERSTATEMENT. GIVEN THE MERCURIAL PACE OF OUR BUSINESS, IT SEEMS THAT THINGS CAN NEVER GET DONE FAST ENOUGH TO STAY AHEAD OF THE COMPETITION.

It is not surprising that in this environment of breakneck speed, we often see major business decisions made quickly with scant information and minimal analysis. On other one hand, that is the nature of the beast. Never has there been an industry with so much at stake, but with so little time to ponder. After all, were we not taught that one of the key traits of a superior manager is the ability to make decisions with limited information, utilizing instinct, "gut feeling" and intuition?

Given the monumental infrastructure costs of the wireless industry and the relative unpredictability of the business, a healthy dose of rigorous financial analysis must support more of our investment decision-making.

In the early, buildup days of cellular—from the mid '80s to the early '90s—we witnessed a torrid pace of network construction. Switches and cell sites could not be built fast enough to meet surging demand nor be the first to market. It was not atypical for cell sites to be erected without questioning or revisiting the underlying economics so that schedules could be met. The end result was that millions of dollars were sometimes sunk into basic infrastructure components that never paid for themselves.

Certainly, the personal communications services (PCS) industry would be chagrined to repeat some of these mistakes as it goes through its early build-out stage. For that matter, as cellular continues through its "fill-in" and coverage enhancement state, it must be careful to not throw "good money after bad." The challenge and mandate for the wireless industry may be to become more habituated to applying systematic financial analysis to major capital investment decisions, particularly cell site and switch investments.

## ROI DEFINED

Return on Investment (ROI) is a primary financial analysis and justification tool that measures the profitability of a proposed investment expenditure. ROI is usually deter-

mined by one or more of the following methods: net present value (NPV), internal rate of return (IRR), or payback period (payback).

NPV works by applying a "discount factor" to a projected stream of future, incremental cash flows expected to result from a proposed capital investment, (e.g., a new cell site, thereby adjusting for the "time value" of money). This discount factor is also known as a "hurdle" rate of return, (i.e., a minimum acceptable rate of return). The higher the level of perceived risk of the proposed project, the higher the discount rate applied.

Most commonly, the discount rate represents what a company believes that it could conservatively earn on other alternative investment opportunities, and is typically equal to or greater than its cost of obtaining financing (known as its "cost of capital"). A NPV of greater than zero indicates that a proposed investment would be profitable under the assumptions employed.

## Market X Cell site build assumptions

Market total POPS	100,000
POPS covered by cell site	10,000
Estimated annual net penetration rate	0.7%
Projected average service revenue per subscriber	\$50
Cost to acquire a 'Net subscriber	\$500
Cost per monthly subscriber bill	\$4.00
Monthly advertising/promotion costs	\$1,000
Monthly roamer processing cost per subscriber	\$1.50
Monthly subscriber bad debt rate	2%
Total depreciable capital expenditures	\$450,000
Economic life of cell site equipment	10 years
Monthly backhaul costs	\$2,000
Monthly landline termination cost per subscriber	\$1.25
Monthly site lease, maintenance and power	\$600
Discount/"hurdle" rate	8%

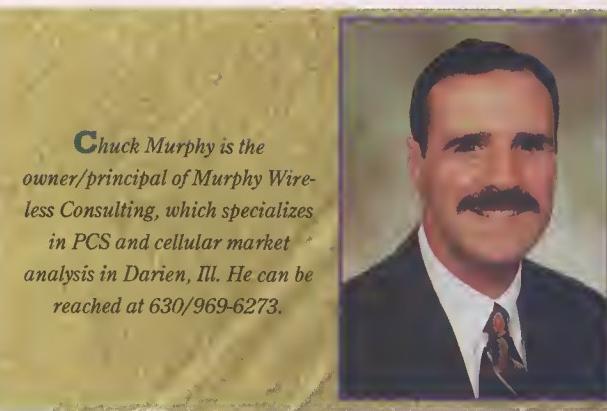
**In the early, buildout days of cellular—from the mid '80s to the early '90s—we witnessed a torrid pace of network construction. The end result was that millions of dollars were sometimes sunk into basic infrastructure components that never paid for themselves.**

IRR is similar to NPV in its logic, and the two methods are often applied in tandem to cross-validate each other. IRR works by deriving an implicit rate of return of a proposed investment, based upon the projected cash outlay(s) for a project and the expected, resulting incremental cash flows.

In effect, IRR compares the amount of money required to make the investment with the amount of money to be earned, and measures the financial return. An IRR which is greater than a company's discount rate indicates that a project is desirable to undertake. An IRR equal to the discount rate would indicate a project of neutral desirability.

Payback measures the amount of time it takes to "earn back", or recapture, money expended on a capital investment. It can be calculated in two basic ways: on a "simple" basis, using non-discounted, projected incremental cash flows; or similar to NPV and IRR, on a discounted cash flow basis. It is more commonly applied on a simple basis, which is the method that will be employed in the charts.

Payback works by comparing the initial cash outlay for a project with the expected incremental, absolute cash flows projected, and measures the number of years (or months) it



**Chuck Murphy** is the owner/principal of Murphy Wireless Consulting, which specializes in PCS and cellular market analysis in Darien, Ill. He can be reached at 630/969-6273.

would take to recapture the initial outlay—in essence "break-even". Although simple payback does not adjust projected cash flows for perceived risk, logic would tell us that the shorter the measured payback period, the less risky a project may be considered.

Payback is an attractive tool to many, because it allows for the easiest and quickest measurement of the three methods, and is usually more easily understood by non-financial professionals. Broadly speaking, a payback of three to five years on a given investment is considered very good to excellent. But it is up to each individual decision-maker to judge what constitutes an acceptable payback period.

ROI is effective as a wireless financial analysis tool and should be employed in virtually every major wireless investment decision-making process. Overall, it is a valuable management tool because it is objective, logical and can be consistently applied across proposed projects from all functional areas of the wireless carrier. It is not, however, intended to be a substitute for good, old-fashioned judgment.

#### Market X cell site pro-forma cash flow worksheet

Projection of cell site generated revenues and expenses

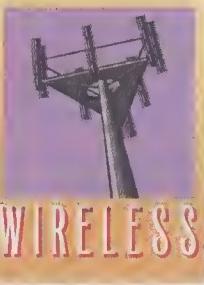
	YR 0 \$	YR 1 \$	YR 2 \$	YR 3 \$	YR 4 \$	YR 5 \$	YR 6 \$	YR 7 \$	YR 8 \$	YR 9 \$	YR 10 \$
Subscriber service revenues	21,000	63,000	105,000	147,000	189,000	231,000	273,000	315,000	357,000	399,000	
Operating expenses:											
Customer acquisition	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000	35,000
Advertising & promotion	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Subscriber billing	1,680	5,040	8,400	11,760	15,120	18,480	21,840	25,200	28,560	31,920	
Subscriber bad debt	420	1,260	2,100	2,940	3,780	4,620	5,460	6,300	7,140	7,980	
Roamer processing	630	1,890	3,150	4,410	5,670	6,930	8,190	9,450	10,710	11,970	
Landline termination	525	1,575	2,625	3,675	4,725	5,775	6,825	7,875	8,925	9,975	
Cell site operating	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	
Cell site depreciation	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	
Switching/backhaul	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	
Total operating expenses	126,455	132,965	139,475	145,985	152,495	159,005	165,515	172,025	178,535	185,045	
Net operating income	(105,455)	(69,965)	(34,475)	1,015	36,505	71,995	107,485	142,975	178,465	213,955	
Addback: depreciation	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	
Net operating cash flow	(60,455)	(24,965)	10,525	46,015	81,505	116,995	152,485	187,975	223,465	258,955	
Cell site capital expenditures	(450,000)	—	—	—	—	—	—	—	—	—	
Free cash flow	(450,000)	(60,455)	(24,965)	10,525	46,015	81,505	116,995	152,485	187,975	223,465	258,955

#### ROI methods:

NPV = "\$66,260"

IRR = 9.7%

Simple payback period = 7.7 years



CHARLES MASON

# Bursting at the seams:

## Wireless providers drench a data-parched market.

J

UST AS IN LANDLINE TELECOMMUNICATIONS, FIRST THERE WAS VOICE AND THEN THERE WAS DATA.

WHILE VOICE IS THE OVERWHELMING DOMINANT FORCE IN WIRELESS TODAY, FOR YEARS SOME HAVE BEEN PREDICTING A HUGE SURGE IN DEMAND FOR WIRELESS DATA. AND PREDICTING, AND PREDICTING.

But while the surge has yet to happen, significant and very positive developments have been occurring over the past year.

There are, for example, a number of well-developed wireless networks in place. There have been quite a few developments in the software and hardware arena, including, most importantly, lower prices.

Prices for wireless modems have been dropping significantly over the past 18 months with some predicting only a slight premium over landline modems within the next year.

In addition, carriers are getting "smarter" about how to market wireless data to customers. For example, easy to buy service/hardware/software bundles are available for some mobile services, with more on the way. Customers are becoming more aware and savvy about the capabilities of mobile data solutions and the needs they can satisfy.

### THE MARKET TODAY

Not surprisingly, both cellular carriers and operators of dedicated packet data networks are going head-to-head in competition for the emerging vertical and horizontal markets. That's because in most cases the technologies and services can serve many of the same customers.

In 1998, while everyone will be skirmishing for market shares, including niche areas, more than a few major national battles are likely to occur

between the cellular carriers and Ram Mobile Data (Woodbridge, N.J.) , which now has the full backing and marketing/technology muscle of BellSouth Corp. (Atlanta). As two-way paging networks are rolled out by the nation's major paging carriers later, they too, are likely to join the fray in earnest.

None of the wireless packet data services have sunk their teeth into anything approaching a dominant market share. One estimate of the number of cellular digital packet data (CDPD) subscribers pegs it at 17,000 as of the end of 1997. With that relatively low number in mind, The Strategis Group (Washington), says that 1998 is pivotal to the success or failure of CDPD, as cellular carriers accelerate their competition against other wireless data networks.

According to Elliott Hamilton, senior vice president at Strategis, a significant head start by any of the competitors could preclude the others from developing sufficient economies of scale to compete.

"This is why it is so critical to achieve subscribers and market share in 1998," Hamilton says.

However, not all analysts agree. "That's nonsense," says Laurence Swasey, senior analyst for Allied Business Information Group, (Oyster Bay, N.Y.). "I think you will see the various networks aimed at computer users grow with no one clear winner or loser. There is a large potential market that has yet to be tapped. But the pieces are falling

into place very rapidly."

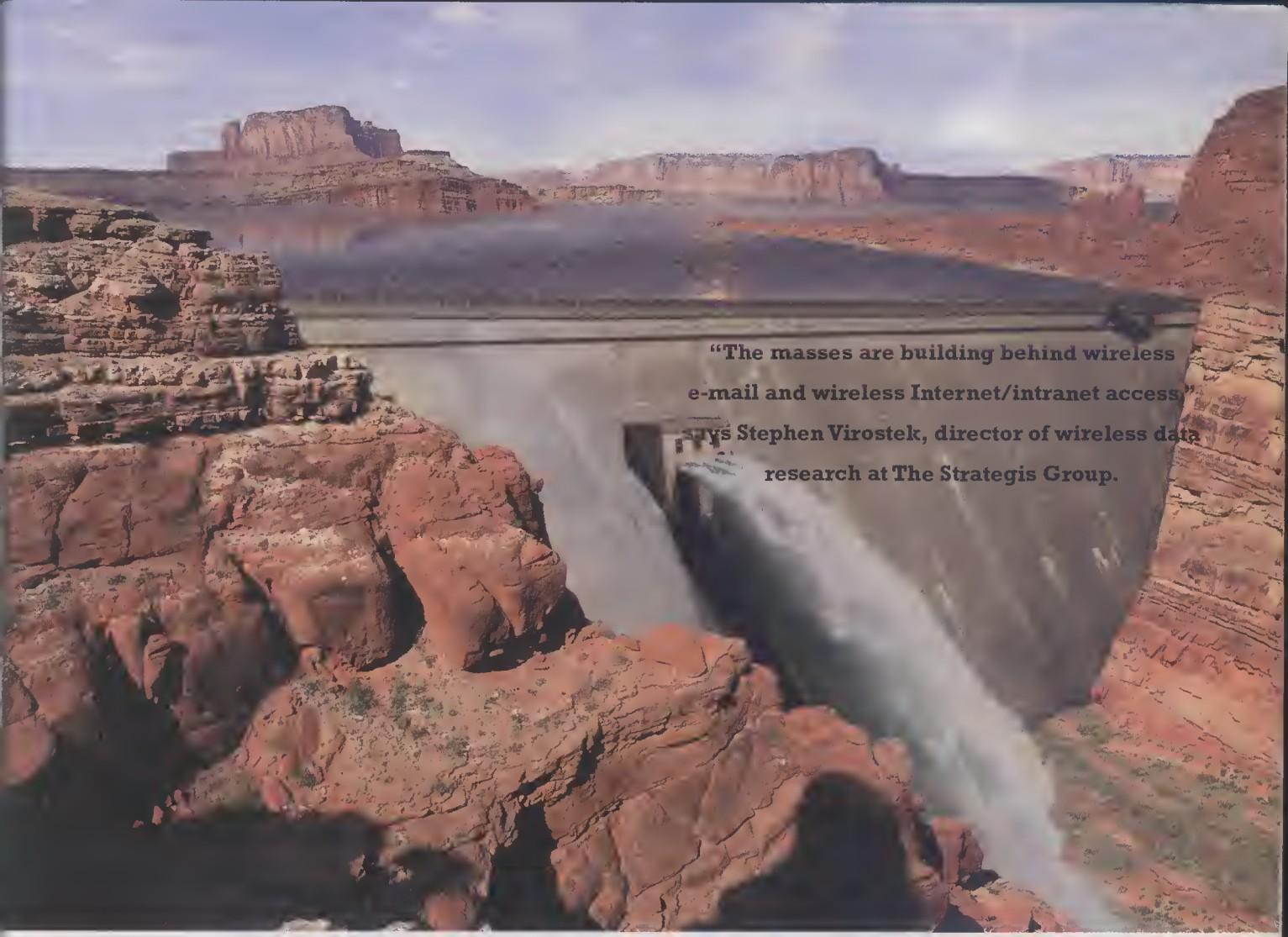
According to many estimates, commercial mobile services did make headway in 1997, albeit relatively small. The Strategis Group estimates about 60% of today's wireless customers use the cellular networks to send and receive data files. But the firm says that last year was a 'groundbreaking' year for all mobile data service providers as they refocused their efforts to leverage rising interest in the Internet, wireless access to corporate intranets, and targeted a broader range of customers with new hardware and applications.

"The masses are building behind wireless e-mail and wireless Internet/intranet access," says Stephen Virostek, director of wireless data research at The Strategis Group.

Indeed, analysts and industry executives say that the past annual prognostications that "this is the year for wireless data" have left some too cynical for their own good.

"We are seeing dramatic developments both on the supply and the demand sides," says Janet Boutros, senior vice president of marketing at Ram Mobile Data. "I know you have heard this before, but the evidence is now incontrovertible."

The Yankee Group's Roberta Wiggins basically agrees that there is room for optimism. Wiggins, director of Wireless mobile communications, says that as the Internet becomes increasingly compelling to the enterprise user, its usefulness also extends to the remote



**"The masses are building behind wireless e-mail and wireless Internet/intranet access,"**  
**says Stephen Virostek, director of wireless data research at The Strategis Group.**

and mobile element of the corporate enterprise.

A Yankee Group report, *The Impact of the Internet on Mobile Computing and Wireless Data*, discusses how Internet technology can enable mobile computing strategies and drive adoption of wireless networks. It also addresses the degree to which mobile access is included in corporate Internet/intranet strategies today.

The firm says about one-third of the U.S. work force, or 43 million workers, are currently mobile, meaning they spend at least 20% of their work time away from a fixed office location. This number is expected to grow.

Of the top 100 U.S. corporations, 87% are developing intranet applications. However, despite these positive developments, the wireless data industry faces several hurdles in selling service to these and other corporations, The Yankee Group says.

Only 20% of surveyed companies claimed to provide remote

Internet/intranet access via wireless to their mobile workers at this time. High costs, security and other priorities were cited as reasons they were avoiding wireless today, according to The Yankee Group.

But the growing mobile work force and the increasing reliance on intranets and other data sources to perform business will mean that companies will be compelled to push their networks out over wireless infrastructures.

The Yankee Group estimates that 33% of large U.S. corporations will be providing field service and sales personnel with wireless intranet access by 2000. A better-case forecast scenario predicts a potential of 21.3 million users by 2002. The higher growth would result primarily from:

- Availability of packaged Internet access solutions;
- Attractive flat rate service pricing for unlimited use;
- Wireless network speeds equivalent to ISDN or above;

- Widespread adoption of Internet-based E-mail;
- Higher value, more personalized Internet content; and;
- User-friendly device interfaces incorporating voice recognition and text to speech technologies.

## TWO-CARRIER APPROACH

Ram Mobile Data (Woodbridge, N.J.) and Bell Atlantic Mobile (Bedminster, N.J.) have broadened their approaches to wireless data during the past year. Each company, for example, has continued to pursue vertical markets, such as the public safety and utility industries, where they have both scored some major successes. However, horizontal markets, notably the mobile professional segment, are just beginning to be taken on in a significant fashion.

"1998 will be a big year for us in mar-

*story continued on page 18*

# An overview of wireless data networks

Today there are several wireless networks offering a variety of data services meeting different needs. A few of these claim national coverage. However, like virtually any wireless service, none offer coverage in every nook and cranny of the nation. Others only claim regional or metropolitan coverage—some for fixed-uses while others offer mobile data services.

While paging services—especially two-way wideband—are full-scale data services, we highlight some of the larger non-paging type data services available:

#### **CDPD**

Interested in capitalizing on their growing networks, most of the major cellular carriers have deployed Cellular Digital Packet Data (CDPD). CDPD is a relatively cost-effective way to leverage a carrier's existing investment in a network designed primarily to deliver voice services.

CDPD providers dedicate a specific number of voice channels to data. In addition to data, CDPD users have the voice capabilities inherent in cellular networks. Data speeds run in the 4,800 to 12,000 bps range. Until the past year, CDPD was best for customers needing limited coverage. However, because of interoperability agreements among the carriers, this is no longer true.

While the carriers and vendors are coming up with better ways to package software, hardware and service, some customers still say the airtime rates are too high. Carriers have continued to offer lower rates and hardware costs—long an impediment—are declining.

CDPD is considered best for short, "bursty" traffic, such as e-mail, transaction processing, telemetry and many types of field service/dispatch services. Public safety has found CDPD to be attractive, in part because of cellular's ubiquity and the types of short-messaging that is inherent in that field.

While most of the largest cellular carriers offer CDPD, their enthusiasm for the service does vary. AirTouch (Walnut Creek, Calif.), for example, offers service in the San Francisco Bay area as part of its joint ownership of a cellular license with AT&T Wireless Services Inc. (Kirkland, Wash.). But unlike AT&T, AirTouch is not a major proponent of the technology.

However, some believe that CDPD is a Band-Aid approach to providing data services and have opted to stay out. They believe that the market for data will be slow to grow, and when the needed momentum is there to build on, so will better technology.

#### **Circuit-switched cellular**

Cellular has long been capable of offering landline-type connections with cellular-enabled computer modems. However, the technology has not been considered very reliable. The data speed is relatively small, usually no greater than 14,400 bps, and it can be costly. However, it does work well, when conditions are right, for lengthy transmissions, such as large file downloads. Carriers have improved the service by installing modem pools.

#### **Dedicated national wireless packet data networks**

Ram Mobile Data (Woodbridge, N.J.) and Ardis (Lincolnshire, Ill.) provide fairly ubiquitous networks throughout the country. While not offering the voice services that cellular can provide, these networks work well for those needing the types of packet data services they offer.

Ram Mobile Data uses the Mobitex system as its communication protocol. However, the company also has transmission control protocol/Internet program (TCP/IP) available. In addition, Ram Mobile is targeting broader markets with its Ramfirst Interactive Paging Service.

Ardis uses the Motorola network originally designed for IBM (Armonk, N.Y.) to serve its field technicians. Because these techs often worked in the depths of buildings, the network more than most others is designed for excellent penetration. Although Ardis has done some marketing to the horizontal sectors, it has focused almost entirely on vertical markets, especially those in field service.

#### **Enhanced specialized mobile radio**

Specialized mobile radio services offer a variety of wireless data products. Arguably the best-known nationwide provider that is targeting vertical and horizontal markets is Nextel (McLean, Va.). The company provides data and voice services over a network assembled through acquisitions of regional operators as well as purchases of licenses.

#### **Cellemetry**

BellSouth, which now has control of Ram Mobile Data, also markets a fixed wireless service called cellemetry. The service is marketed to cellular carriers who, in turn, sell it to customers for such uses as alarm and meter monitoring.

—Charles Mason

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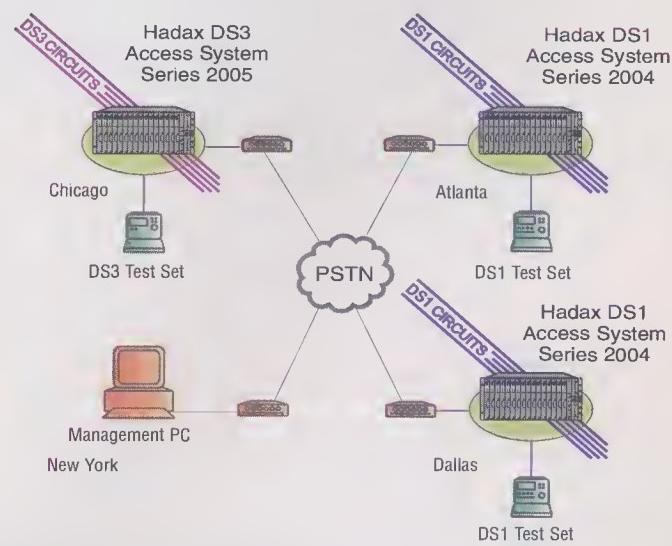


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*continued from page 15*

keting wireless Internet access," says Mike Franklin, executive director of marketing for Bell Atlantic Mobile's wireless data operations.

The company recently began selling an all-you-can-eat service for \$54.95 that allows mobile users access via CDPD to the Internet. "We plan to market this service during the year and expect it to grow substantially," he says.

Ram is also targeting the horizontal markets with its two-way messaging system. The system, which is beating several of the national narrowband paging licensees to the punch, is oriented toward an array of customers, including mobile professionals.

Signaling possible early success, Research In Motion (RIM; Toronto), recently signed a contract to increase its supply of two-way pagers to Ram Mobile Data. The contract represents an enlargement of RIM's 1997 agreement to supply RAM with two-way pagers valued at approximately \$70 million to be delivered throughout the 1998 calendar year.

The additional order is for \$20 million with the incremental two-way pagers scheduled for delivery in the first quarter of 1999. RIM's Inter@ctive Pager provides Internet and intranet connectivity in a palm-sized pager with a full keyboard and graphical display, allowing users to receive, respond and initiate messages from a small, lightweight communications device.

Ram's Boutros says that devices like the Inter@ctive pager and the services they make possible are critical to bringing wireless data to the mass market in significant numbers. "This year is going to be pivotal to the wireless data market," she says. "You are going to see many new devices introduced that will meet the varying needs of a broad array of customers."

Boutros adds that while cellular carriers have sometimes benefited from their name recognition, the agreement by BellSouth to sign a definitive agreement in October to obtain control of Ram Mobile Data by buying its partner, Ram Broadcasting Corp., will play a signifi-



A Boston Edison field service specialist enters service updates into his pen-based computer, which sends and receives real-time customer information over Bell Atlantic Mobile's AirBridge cellular digital packet data (CDPA) network.

cant role in the company's future plans.

Ram Mobile's previously announced network enhancements already under way will continue, she says. Network coverage will increase by doubling the number of base stations to 2,400 and upgrading technology to improve base station sensitivity.

"The resulting additional coverage is designed to be comparable to that of one-way paging," Boutros says.

In addition, the new base station technology will enable smaller, less powerful devices, such as handheld personal computers, to have the longest battery life in the industry, Boutros adds. "Battery life is a key to making wireless data work. If devices have short battery lives, as many have had, customers won't want to use them on a consistent basis."

While Boutros declined to comment on rumors that a name change for Ram reflecting the new relationship with BellSouth is in the offing, she would say that Ram planned to fully leverage the BellSouth well-known brand name and its reputation for quality service.

Bell Atlantic's Franklin agrees that new, more functional and less expensive devices are helping to accelerate the adoption of mobile data. He points, for example, to the popularity of such devices 3Com Corp.'s (Santa Clara, Calif.) Palm Pilot.

"NovaTel is planning to soon release a CDPD-modem for the Pilot," Franklin notes. "And this is only the beginning."

Despite their new attention to horizontal markets, both companies plan to continue their pursuit of vertical industries. A case in point is the fast-changing utility industry.

Detroit Edison, which supplies electric power to more than 2 million customers in southeastern Michigan, recently selected Ram Mobile Data to provide wireless data communications service for its field automation system. The wireless solution is replacing a system of two-way radios and paper-based work orders for nearly 300 field service technicians in Detroit Edison's Customer Field Center, who perform

*continued on page 21*

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- N Internet Service Provider/Commercial Online Service Co.
- O Systems Integration/Outsourcing
- P Other Carrier
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- 12 Engineering (Network Designer, Engineer, Technician)
- 25 Data Communications/Digital/IS/MIS Mgmt. (Data Communications, Digital, IS VP, Director or Mgr.)
- 13 Mgmt. (VP, General Mgr., System Mgr., Mgr., Director)
- 3 Corporate Mgmt. (Chairman, Owner, President, Partner, Executive/Senior VP/Director, Treasurer, CFO, COO)
- 4 Legal, Financial, Regulatory or Processing Services (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
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- D Cable/Video/Multimedia Equip./Services (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
- E Customer Premises, Broadband Subscriber Equip./Services (PBXs, Station Equip., ACOs, Videoconferencing, Remote Controls, Converters)
- F Outside Plant and Construction Equip./Services (Pedestals, Vehicles, Towers, Tools, Enclosures)
- G Data Communications/MIS/Network Mgmt., Support Equip./Services (including LANs, WANs, and Network Software)
- H Power & Protection
- I Test & Measurement
- J Other (please specify)
- K None of the Above (A-J)

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**BELL'S WIRELESS DATA SOLUTION, BOSTON**

Edison service technicians had to report to their offices each morning to receive printed work orders for the day's schedule. Last-minute changes were sent from dispatchers to field service technicians via private radio, which meant communications were delayed if field personnel were not in their vehicles or near their radios. This resulted in longer waiting periods for customers.

Ram Mobile Data, Sweden's Ericsson Inc., GoAmerica Communications Corp. (Hackensack, N.J.) and Melard Technologies, a manufacturer of



Metricom's Ricochet modem is an example of mobile packet data service.

**MOBILE LAST YEAR SIGNED BOSTON**

Company as one of its largest CDPD customers, taking business away from Ram. Boston Edison's electrical service business unit is using pen-based computers to send and receive real-time information on customer orders over Bell Atlantic Mobile's CDPD network.

The new automated system allows field personnel to directly receive real-time information on customer requests, maintenance orders, collection orders and customer billing history, according to Frank Antonacci, senior data account representative with Bell Atlantic Mobile. Once a job is completed, details are entered into a pen-based, portable computer and sent back, real-time via CDPD, to the appropriate databases.

The wireless connection to Boston Edison's field service specialists will improve overall response time to customers, reduce order processing time, improve accuracy, increase productivity, and lower the number of recurring orders—all adding up to improved customer satisfaction and significant cost savings as well, Antonacci adds.

Gerald Mata, Boston Edison's field service project manager, says that the company chose CDPD technology over a number of wireless services tested

in a portable manner.

because it was found to be the best fit for Boston Edison's high throughput requirements.

But Antonacci says that Boston Edison was a 'tough sell.' "They were already using wireless, so they didn't need to be convinced of its merits," he says. "But they were looking to the future and we had to convince them that we could meet their long-term needs."

Data throughput speed was but one issue. Other key factors were coverage and data security. "We had one area that was not covered and we agreed to have it covered before when they signed the contract and it was," Antonacci adds.

"The awareness has changed significantly," says Bell Atlantic Mobile's Franklin. "This, along with the new products available that perform as advertised is creating a strong basis for growth."

A growing wireless data pie should provide room for growth for the major competitors. In addition, niche players, such as Metricom Inc. (Los Gatos, Calif.) and several fixed-wireless providers will have their market corners as well, Allied Business' Swasey adds. ■

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*continued from page 18*

service connections/disconnections and meter installs and tests. Executives at the utility say the solution will enhance their ability to improve communications between field workers and their dispatchers or other corporate staff. This in turn will improve customer service, streamline operations, reduce paperwork and free-up service representatives to spend more time servicing customers, according to Robert J. Buckler, Detroit Edison executive vice president.

"Our customers already are seeing significant differences in response times as well as responsiveness to their inquiries," says Buckler. "We're even looking into equipping other areas of our mobile work force such as troublemen, linemen and construction crews with wireless data solutions."

Buckler says that before switching to Ram's wireless data solution, Detroit Edison service technicians had to report to their offices each morning to receive printed work orders for the day's schedule. Last-minute changes were sent from dispatchers to field service technicians via private radio, which meant communications were delayed if field personnel were not in their vehicles or near their radios. This resulted in longer waiting periods for customers.

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rugged mobile computing and data communications products, have joined to offer utility companies a rugged, Windows 95-based wireless data communications and computing solution, Go.SCOUT, which incorporates wireless intranet and Internet access. The Go.SCOUT bundled solution developed expressly for Ram's Mobitex wireless data service can give field workers wireless access to their corporate intranet and the Internet in seconds.

Not to be outdone, Bell Atlantic Mobile last year signed Boston Edison Company as one of its largest CDPD customers, taking business away from Ram. Boston Edison's electrical service business unit is using pen-based computers to send and receive real-time information on customer orders over Bell Atlantic Mobile's CDPD network.

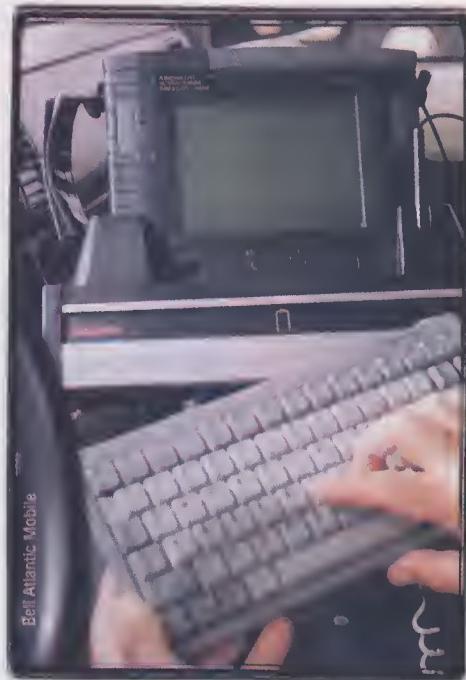
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Metricom's Ricochet modem is an example of mobile packet data service.



Norland Corp.'s Pen Key 6600 pen-based, hand-held, 486-based computer can be docked in service vans or used in a portable manner.

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**George Schmitt**

*President of Omnipoint Communications*



**“In New York, you have to be different  
to stand out in a crowd.”**

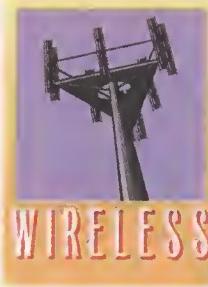
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MICHAEL FRENCH

# Criteria for success

There are three ways to gain wireless market share.

## Instant INSIGHT

**E**verybody agrees that wireless markets are becoming more competitive and that success factors differ between the business and consumer markets. What is not well understood is how decision-makers in these different markets select one wireless service over another. What are their critical selection criteria? How should carriers appeal to mobile business users or consumers to gain market share while earning a reasonable profit?

Insight's market research shows that coverage and service availability are primary needs for both markets. However, consumers consider monthly service price as the deciding factor in carrier selection, while business customers look at a service's net cost or total return-on-investment (ROI) when deciding which service to purchase. The chart summarizes these critical differences.

Mobile workers are pressured to improve productivity; however, for consumers, productivity is still undefined. For example, a wireless service that allows sales people to enter orders from the field or review a customer's credit status or back-order position (thus saving them from having to go back to the office) is worth more than a plain voice service. For healthcare professionals, a wireless service that combines voice with short messages or pages can save valuable time. By providing an enhanced service, the wireless carrier is able to differentiate itself from competing carriers. From the mobile workers' viewpoint, the wireless carrier is able to improve their productivity.

As competition intensifies, there are three basic ways that carriers can gain market shares:

- By offering the lowest price, which likely will lead to a destructive price war with other carriers;

### Key carrier selection criteria for wireless markets

Decision criteria	Business users	Residential users
Monthly service cost	★★	★★★★★
Net productivity gain	★★★★★	★★
Service coverage	★★★★	★★★
Security	★★★★	★★
Internet access	★★★★	★
Paging messages	★★★	★★

*Notes: Importance rating: Five stars = Most important*

*Assumes handset features equivalent for all. Work-at-home included in residential markets.*

- By providing innovative services (often a sound strategy; but its advantage is temporary as competing carriers typically will have similar services within six months); and
- Knowing customers' needs well enough to provide services tailored to their specific needs—the preferred strategy. This not only avoids costly price competition, it appeals to precisely those customers that carriers wish to retain—purchasers who value high-margin services and are less likely to switch carriers. As wireless competition increases with more PCS operators and resellers, carriers need to establish leadership in niche markets with targeted customers. Alternatively, they

risk continued low profitability. As the number of wireless carriers in given markets increases from two to five, less profitable carriers are likely to be bought up by their more prosperous competitors (since few markets can support five carriers). Only by differentiating services and knowing customers' needs can wireless carriers reach the critical number of subscribers needed to sustain profitable operations.

Michael French is vice president of market research for The Insight Research Corp., a Parsippany, N.J.-based consultancy providing comparative market research and competitive analysis. Insight's recent work includes studies in the areas of OSS, wireless IN and resale.



## WIRELESS

# Notebook

CHARLES MASON

### WHAT DO CUSTOMERS WANT? ENHANCED SERVICES

A majority of wireless users—63%—reportedly would like a single provider for all of their telecommunications requirements, such as wireless, local and long distance services, and Internet access. Of the heaviest wireless services users (those spending more than \$50 per month), 73% were interested in having a single provider. In addition, 34% expressed interest in receiving a single bill for all services.

These are a few of the major findings in a report by **The Yankee Group** (Boston). As competition heats up, customers will demand simplification of their services, forcing carriers to bundle and package services into a unified offering. This latest research reinforces other studies that continue to find a strong interest in a single-number service that integrates home, wireless, office and pager.

The Yankee Group says that enhanced services, which offer an opportunity for customers to consolidate their increasingly complex and very mobile lives, includes personal number services (PNS) and electronic personal assistants (EPA). PNSs offer integrated functionality across multiple communications services. Customers can use one phone number for work, home and wireless communications. To date,

fewer than 2% of wireless users subscribe to a PNS; more than of current wireless users are interested in a PNS, but most aren't willing to pay more than \$10 a month for the service. This is less than PNSs currently cost.

EPAs take the PNS concept a step further by integrating a voice user interface as a gateway into the application suite, researchers note. EPAs act as electronic 'assistants,' performing a range of personal information and call-management functions (such as taking messages, announcing callers and keeping track of subscriber schedules).

Leading vendors in the PNS market include **AccessLine** and **Priority Call Management**. Key EPA suppliers include **Wildfire Communications** and **General Magic**. Other vendors developing products include **Call Sciences**, **Avirnex** and **Premiere Technologies**.

While these products, in their early generational stages, have proven to be far from market grabbers, the Yankee Group study says this is changing. In fact, both PNS and EPA products have improved significantly over the past two years for several reasons:

- Improved voice recognition, which allows for better interface;

- Integration with the Internet (subscribers can configure personal Web pages to manage location profiles, number lists and screening features);
- Parallel processing of computer platforms (lower risk involved for carriers which allows for a customized approach and an *a la carte* selection of features); and
- Enterprise-wide solutions (PNS can be integrated into a corporate environment).

David Berndt, program manager in Yankee Group's wireless/mobile communications practice, says these services will help carriers give customers what they desire: "the opportunity to integrate their communications into one cohesive service." Customers are interested in enhanced services as a whole, with 50% of wireless subscribers considering that the features offered by the carrier are important to their purchase decision, Berndt says.

PNSs and EPAs, along with the other enhanced wireless services, will play a significant role in the future of the wireless market, he adds. But the movement toward greater offerings is fraught with challenges for carriers and their vendors. Berndt says that it will be up to the carriers to determine how best to segment the market to offer these new services successfully.

### WHAT'S THE STRATEGY?

With cellular and personal communications services (PCS) providers going head-to-head in most large- and medium-sized wireless markets, the issue of what will attract the most customers is on everybody's front burner.

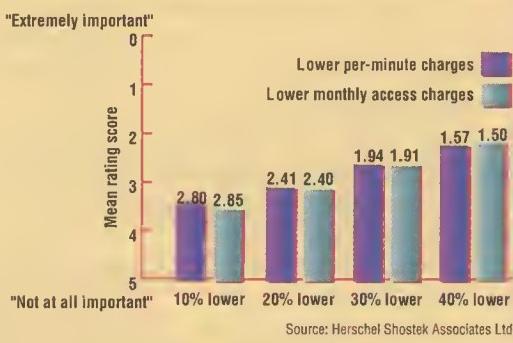
**Sprint PCS** (Kansas City, Mo.), for example, has been offering significant packages of cut-rate airtime to new customers. Some incumbent carriers have followed with lower airtime charges while ratcheting up their monthly access tariffs.

But while many cellular carriers are cutting airtime charges in response, their overall strategy is not necessarily the way to proceed, according to **Herschel Shostek Associates Ltd.**, (Wheaton, Md.) Based on its research, the strategy of some cellular carriers to hike up access charges while reducing airtime charges doesn't make economic sense.

Since 1991, cellular carriers in the 10 largest U.S. markets have reduced airtime tariffs by 19.6% to 23.8%. However, carriers have increased tariffs for access by 11.8%. This implies that reductions in airtime are more important than cuts in access for attracting and keeping new customers—but this is not the case, Herschel Shostek Associates concludes.

It is true that reductions in access or in airtime are equally effective in drawing new subscribers. The problem is that reductions in access cost carriers less than cutting airtime. Shostek estimates that total revenues per subscriber would be \$12 more per year if a carrier cut access charges rather than airtime.

In a subscriber base of about 50 million, that amounts to a revenue loss of \$600 million, Shostek researchers maintain.



Source: Herschel Shostek Associates Ltd.

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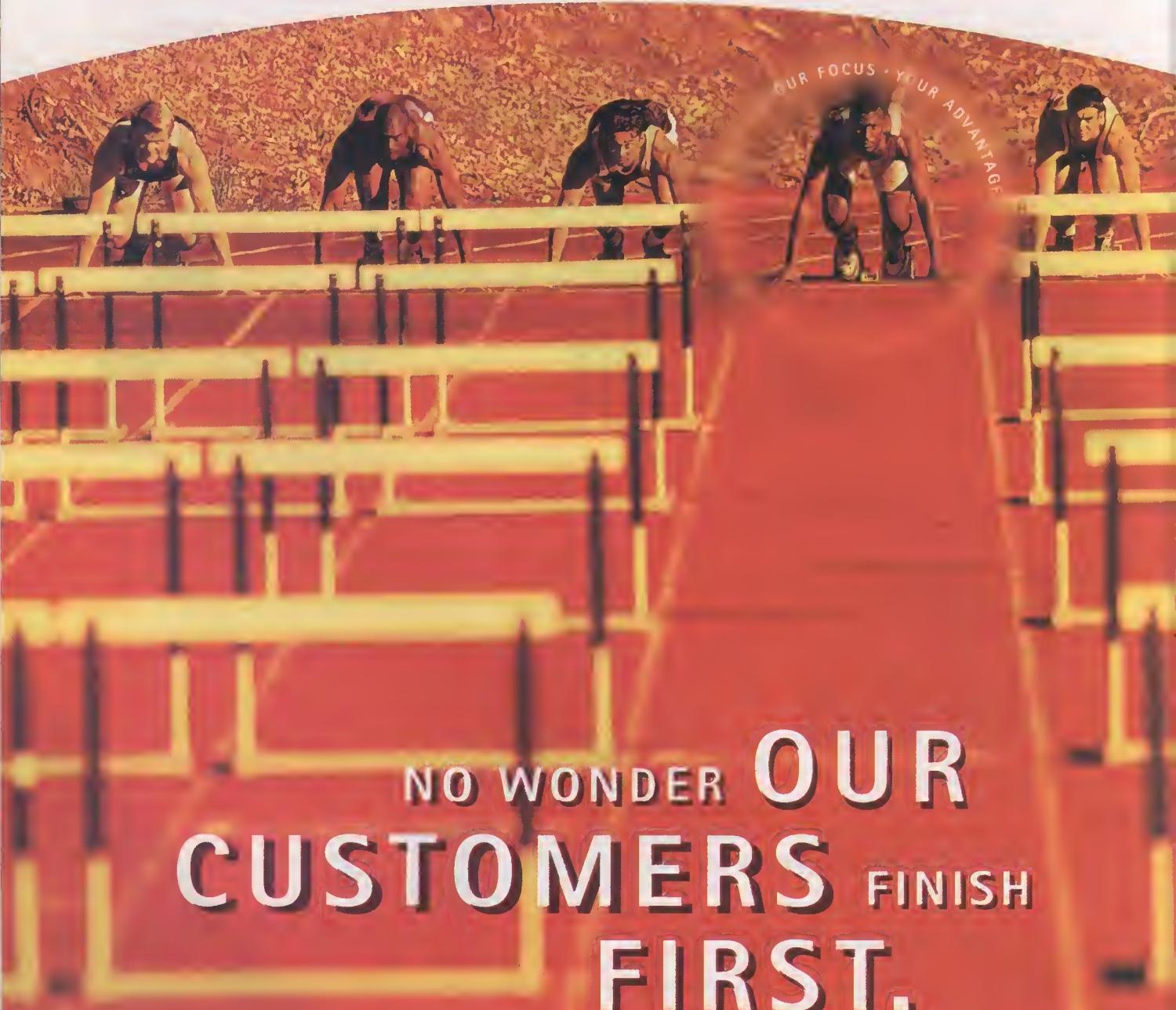


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DAVID KOPF

# Taking it on the road

## Mobile IP might be a good reason for ISPs to consider offering wireless services.

# W

ill Internet service providers (ISPs) start playing in the wireless data game? It may sound like a bizarre question, but as an emerging private networking technology, Mobile Internet Protocol (Mobile IP), might entice ISPs to ask themselves this very question.

In the past, the standard wireless Internet access model for public networks has followed this rough outline: a user establishes a modem connection with a wireless provider's network (choose an air interface), and an Internet connection is then made back at the headend/central office-type facility. There's only one problem with this model, the user's IP address always changes. What if the user wants applications that hinge on them retaining a single IP address?

Enter Mobile IP. Mobile IP, currently being proposed for geographically dispersed enterprises with users that travel from one office to the next, but still need to retain a constant IP address, might find a public networking application as subscribers grow interested, and as businesses put more of what they do on the public Internet—in virtual private networks, for example.

### WHAT IS MOBILE IP?

If IP does routing, then Mobile IP is a way to export IP's routing capabilities to a mobile environment. Basically, Mobile IP helps route packets so they will get to the mobile node, even when it's not really where its IP address says it should be, says Charles Perkins, a senior staff engineer and manager of group engineering for the chief technology office for Sun Microsystems' (Palo Alto, Calif.)

advanced networking group. Perkins is also author of *Mobile IP Design Principles and Practices* (Addison Wesley Publishing).

In Mobile IP, the mobile user belongs to a mobile node. The mobile node's address is called the "home address," which makes the mobile node look like it's on the home network. Whenever packets show up on the home network, either the mobile node is there (the user is local) and it gets them, or it's not there (the user is mobile) and an agent called the "home agent" grabs the packets and sends them off to wherever the mobile node is, Perkins says.

"The home agent sits on the home network and the way it gets packets to where the mobile node is, is because the mobile node tells the home agent where it is," he says. "What it uses to do that is called the 'care of' address, which is another IP address. It's like a forwarding address."

The way the home agent sends packets to the mobile node is by taking the original packet and sticking in a "care of" address in front of it, Perkins says. "The whole original packet is the same as it was before," he continues, "but this process of encapsulation puts another header on it and the destination in the new header is the care of address. The care of address sits in front of the packet and the Internet routers send it along to the network to the care of address. Before the mobile node gets the packet, you just have to strip off the header that you stuck on in front of it."

When the packet shows up the care of address either the mobile node is waiting at the care of address and it received the packets immediately, and strips off the header, or if the mobile node is away, a foreign agent receives the packets. The foreign agent lets any

connecting mobile node use its care of address. When a mobile node moves to a new area, it connects with the local foreign agent to get that agent's care of address, and then tells its home agent the new care of address, Perkins says.

"This is all happening in real time," he says. "The packets go directly to the mobile node. There's no storage. It's exactly the IP model of connections, best-effort delivery. That's why Mobile works so well. Essentially, TCP [transmission control protocol] and all the higher level protocols can't tell the difference. They can't tell whether the mobile node is moving."

### MOBILE IP POTENTIAL

If anything, right now, Mobile IP is for all intents and purposes a wireless LAN-type technology. All the trials the technology has undergone have been via interfaces such as infrared connections, Perkins says. Carrier detection plays a large part in explaining this.

Infrared works a lot like Ethernet in that it is able to perform carrier detection, which lets it know that it is in range of some sort of base station or wireless connection point, Perkins says. If a wireless technology can't easily perform carrier detection, then it's much less conducive to Mobile IP.

However, any limitations on hardware aren't the only criteria for Mobile IP implementation. From an addressing perspective, Mobile IP could make a good alternative to today's model of wireless Internet access, especially in applications where users need static IP addresses.

"If Mobile IP were deployed in that situation," Perkins says, "the whole protocol and apparatus for performing these changes of location would be a lot simpler than it is now."



# Notebook

## NETCOM TEAMS WITH .COMFAX

**Netcom On-Line Communication Service Inc.** (New York) and **.comfax** (San Jose, Calif.) have brought together an Internet faxing service.

Since December, .comfax software has allowed any document created on a PC to be sent around the world simultaneously. This provides economies of scale that standard faxing does not permit: the capability to send 1,000 faxes in the time it takes to send one without tying up phone lines. "There is a strong resilience on fax services for business communication and we believe the Internet will become the medium of choice faxing," says Mike Kallet, Netcom senior vice president of products and service. "By taking advantage of .comfax's Internet network and software, we integrate Internet faxing with e-mail and Web services."

When away from the office, Netcom customers benefit from the .comfax Inbox service, allowing customers to receive faxes in a "virtual fax inbox."

Netcom customers may register for a free trial account by downloading .comfax software online at <http://netcom.com/services/fax.html>. The trial includes 10 minutes of free faxing in the United States. After the trial period, users pay 15 cents per minute for faxing anywhere in the country, and varied rates internationally.

## SPRINT INTERNET PERSONAL TRAINERS

### GET YOU IN SHAPE

Getting the most out of your time online is easier than you may think.

**Sprint Internet Passport** (Kansas City, Mo.) is offering the Sprint personal Internet trainers service. These skilled corps of Internet experts provide personalized coaching to help customers make the Internet as productive as possible. The trainers can answer a wide range of questions to help novices and expert users get the most out of their time online.

Customers can call Sprint trainers directly and receive personalized coaching and attention. The trainers teach customers to be more productive at the same time. Questions can range from how to personalize your desktop and use popular plug-ins to finding help for your taxes and planning a vacation.

All callers receive a personal e-mail follow-up summarizing the call, and offering additional information and tips related to their inquiry. The service is available to Sprint Internet Passport customers for \$9.95 per call. Customers can call back within 48 hours at no charge if they need to continue work on that specific question.

For a Sprint Internet Passport subscription, after the first month free, customers elect a flat rate of \$19.95 per month for guaranteed unlimited access. Call 800/359-3900 to receive a free software package. New customers can also register online at [www.sprint.com/sip/registration](http://www.sprint.com/sip/registration).

DEBBIE L. SKLAR

## FULLY INTEGRATED WEB APPLICATIONS SUITE OFFERED

**GTE Internetworking** (Irving, Texas) will offer a fully integrated Web applications suite focusing on bringing secure business-to-business services to the Web. The suite of applications, Re@ch Enterprise includes:

- Knowledge Re@chTM, a comprehensive extranet solution facilitating information distribution and knowledge management;
- Commerce Re@chTM, an application allowing online catalog, payment and fulfillment; and
- Service Re@chTM, a customer self-service application to provide secure, personalized access information.

The suite helps **Global 2000**-class companies reduce costs, improve competitiveness, and enhance customer relationships by implementing scalable, secure Web-based business applications. Knowledge Re@ch and Commerce Re@ch are available and Service Re@ch will be available mid-year.

## EUROPEAN PTOs CONTROLLING INTERNET

Global technology analyst consultancy **Datamonitor** (London) reports public telephone offices (PTOs) are strengthening their command of Internet access markets and their online services are emerging as strong competitors.

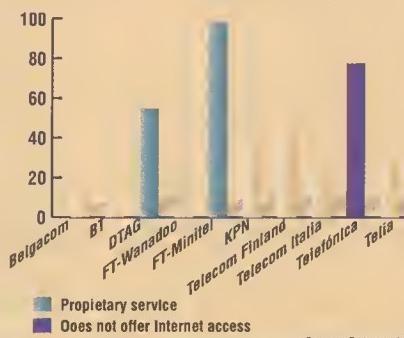
Findings in the report *PTO strategies for consumer interactive services: Profiles of key industry shapers* include: Combined, European PTOs control 34% of Internet and online access in Europe and European PTOs are increasing their online content and services provision in an attempt to dominate the new market.

The PTOs in nine key European markets control 34% of Internet access on average, but market shares vary from 2% for **BT Internet** to use 55% for **T-Online, Deutsche Telekom's** online service.

Companies like **Belgacom, BT** and **France Telecom** have failed to take advantage of their dominant positions in domestic telecoms markets to achieve Internet access control. However, they are taking significant proportions of new subscribers to gain market share. Some PTOs like **Telecom Finland** and **Deutsche Telekom** have succeeded in using their strength in voice telephony to build a high market share. They have done so by transferring videotex users to their Internet services.

For operators with a monopoly in telecoms national language Webs can also give dominance of Internet access. **Telefonica** supports 95%

% of ISPs on **InfoVia**, controlling 80% of Internet access in Spain, and **PTT** **Telecom** will follow suit with **Het Net**, a Dutch-language Web.



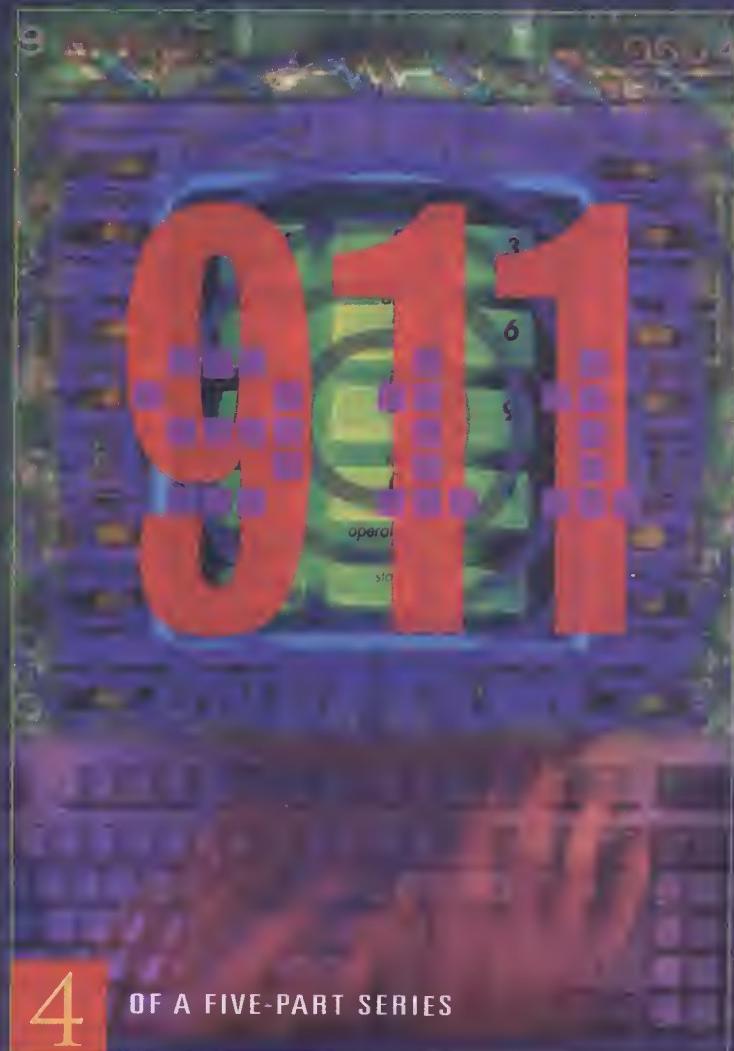
Source: Datamonitor

SPECIAL ASSIGNMENT

# NETWORK RELIABILITY

The Health And Safety Of The Public Network

RELIABILITY DURING  
EMERGENCIES



4

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# NETWORK RELIABILITY

## Shaken, But Not Stirred

Imagine losing power in 100 central offices and subscriber loop carriers all at the same time.

It's not hard for Bell Atlantic/Nynex to imagine. The regional Bell operating company lived the nightmare six weeks ago when a 100-year ice storm knocked out power lines and turned New York and New England into a giant popsicle. Probably the only ones smiling through the (frozen) tears were the portable power supply manufacturers.

How are public network carriers ensuring network reliability in the face of emergencies, natural disasters and even human error?

Earthquakes, floods, ice storms, wildfires and hurricanes—while

expected as part of living on this earth—are still real threats to the health and safety of the public network. Moreover, with provisions brought about by the Telecommunications Act of 1996—most notably, unbundling and interconnection—the opportunity for human-borne tampering (accidental or not) has skyrocketed. We're in for some surprises.

In our fourth installment "**Reliability During Emergencies**" of our series "The Health and Safety of the Public Network," we examine what types of potential disasters and network derailments lurk around the corner; provide some case-by-case scenarios of how networks are brought back up (and kept from falling down in the first place); and study how risk management guidelines, preparation of outside plant, and proactive software configuration and maintenance all work together to so that when disaster strikes, the network may be shaken, but service is not stirred. ■

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## RELIABILITY DURING EMERGENCIES

# A World With New Rules

How to manage risk in the land of interconnection and interfaces.

**By Barbara Reagor**

Barbara Reagor is senior director of disaster management services at Bellcore (Morristown, N.J.).

The public switched telecommunications network (PSTN) is a marvel of complexity and reliability. Not only is it there when we want it; it's there when we really need it. When our towns are flooded, blown flat by hurricanes, torn apart by tornadoes, shaken by earthquakes, the PSTN is never down for long and, often, not down at all. Even when network managers make the wrong decisions, the PSTN still delivers dial tone.

Now, however, technology, the market and public policy are evolving an entirely new network. Telephony, the Internet, cable television (CATV) and satellite service—once separate networks—are becoming the network of the new millennium. New services are requested and created, new capabilities introduced, new fortunes made. Governments which once wrote regulations to preserve stability now repeal them to encourage competition and creativity. Opportunity abounds.

So does risk.

The evolving network is subject to most of the old risks and many new ones. There has been explosive growth of interfaces into the network, and each interface carries risks—including many we can only imagine.

## A Reasonable Goal

What should telecommunications carriers do to identify and manage risk as the network evolves?

The President's Commission on Critical Infrastructure Protection (PCCIP), which met last summer to consider some of these issues, rallied around the term *network assurance*—a term that has been and will

be useful to any carrier grappling with risk in the new environment.

Network assurance is the relative reliability, security and transmission quality of the network, and the timely access to it by its customers. On the component level, network assurance can be degraded by hardware and software failures, security intrusions, congestion overloads, planned downtime, dramatic natural disasters or human error. At the service level, network assurance can be seriously impaired by the interactions of the systems which make up the network. Network assurance also embraces the network segments (another PCCIP term) which have been seen as distinct until now—the Internet, CATV, wireless services and satellite-based services. These segments are converging, and they are likely to be integrated into a single infrastructure early in the 21st century.

Forward-looking carriers should aim to provide a high level of network assurance to meet the needs of its customers through the identification, quantification, prioritization and management of risks facing the network.



**Network assurance is the relative reliability, security and transmission quality of the network, and the timely access to it by its customers.**

**New CATV, Internet, wireless and satellite carriers may not have had the opportunity to establish best practices or identify the new risks to which convergence exposes them.**

### Risk

A risk is a chance that a potentially destructive event will happen. Given the knowledge that these events will happen, the first step is to identify the risks generated by new developments in technology, the market and public policy.

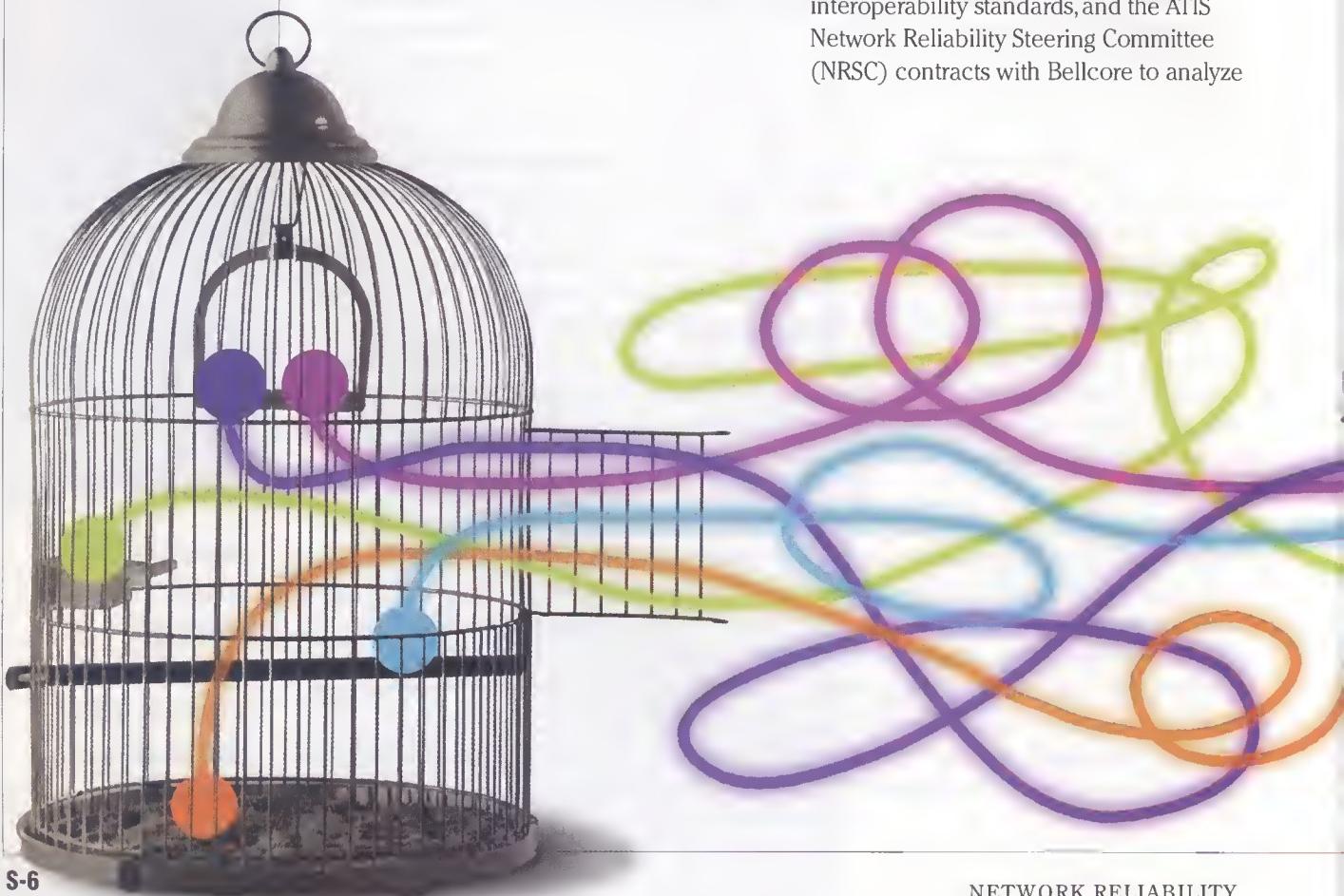
The new interfaces into the PSTN increase the power of the network, but they also increase its complexity, and complexity carries risk. Currently, network segments connect to the PSTN in clearly defined points of presence, and traffic is handed cleanly between these elements. One example of this is how traffic moves from a wireless network to the PSTN. But in a few years, a service may be connected across multiple segments. Something as commonplace as a voice telephone call may someday originate with a CATV provider, bounce to a satellite, and be connected to the wireline network through a wireless carrier.

Not only is this interaction technically complex, but the differing expectations

that operators of each network segment bring to the interaction add to that complexity. The PSTN and the equipment in it were designed to meet published, industry-accepted objectives. These objectives were described in extremely detailed documents available, not just to the industry, but to state and federal regulators. Nothing similar to this exists for new network operators, such as Internet telephony or satellite service providers.

The PSTN also has well-established and highly visible procedures for managing risk. The government's Network Reliability and Interoperability Council (NRIC) keeps watch over the performance of the PSTN.

The telecommunications industry also has its own established organizations, such as the Alliance for Telecommunications Industry Solutions (ATIS; Washington, D.C.), which support forums and committees to resolve industry issues through consensus. ATIS' T1 committee creates interconnection and interoperability standards, and the ATIS Network Reliability Steering Committee (NRSC) contracts with Bellcore to analyze



FCC outage reports. It shares those results with the industry.

Finally, state and federal regulators pay close attention to the overall reliability, stability and accessibility of the PSTN. With all this support and scrutiny, most established telecommunications carriers have invested heavily in network assurance. They've improved their physical network and software monitoring and control, worked on their response to customer troubles, and spent large sums on training and research. The impact of all this work will persist for years.

But not forever.

The market is forcing changes on the structure of the industry. Established carriers, like their new rivals/partners from the CATV, satellite, Internet and wireless industries, are jockeying for market position. They've cut back on research budgets, "right-sizing" their workforces and losing many of their most skilled workers.

New CATV, Internet, wireless and satellite carriers may not have had the opportunity to establish best practices or identify the new risks to which convergence exposes them. People working in each of these new segments, understandably, may be devoted to the growth and success of their segment, and may have a comparatively narrow view of the network at large.

Some of these segments may be managed better than others. Even segments that are very well managed may

have a different set of procedures for dealing with outages than their neighbors. It's possible that a service—again, something as basic as a voice telephone call—could fail as it crosses a poorly managed part of the network, just as a train may derail on a badly maintained section of track.

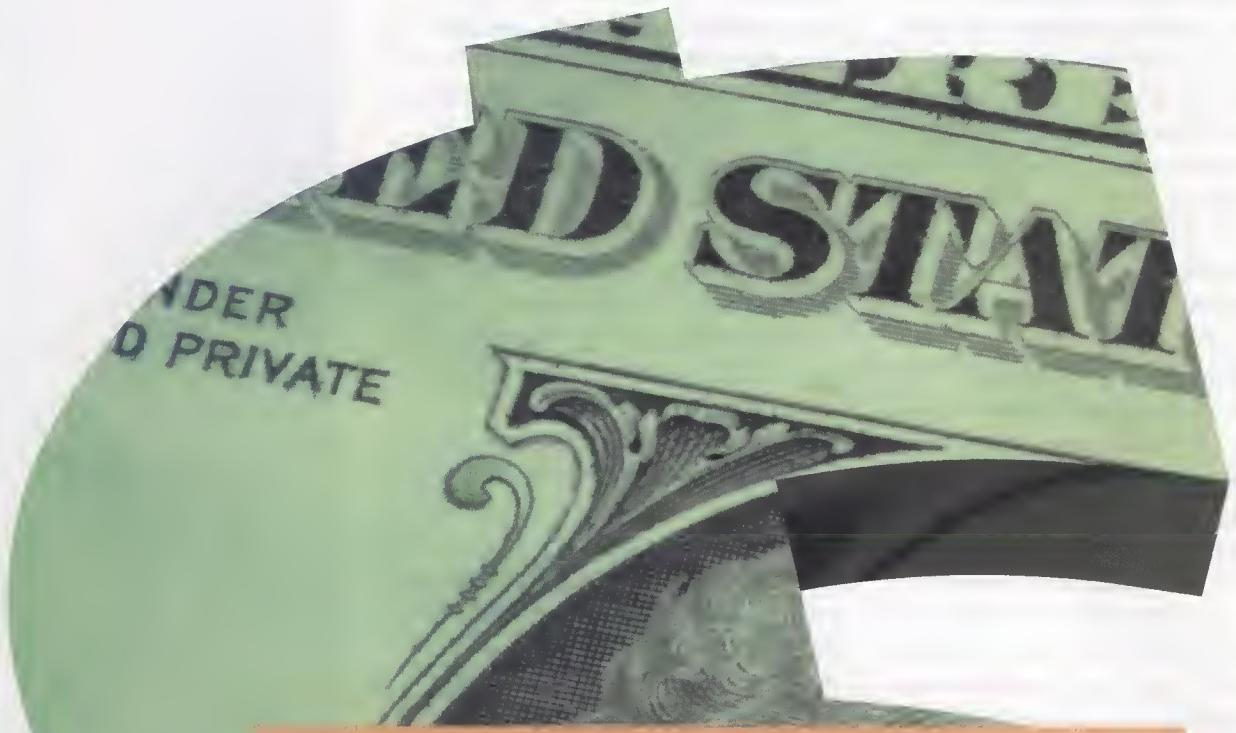
It is possible that customers trying to sort things out after a network disruption occurs may be less than totally satisfied with the results. They may encounter the same kind of finger pointing that computer users can experience: "Looks like a software problem to me" or "Oh, that's a hardware problem."

There are more ominous possibilities: theft and sabotage. Competitors will be connected through the network, and, human nature being what it is, the temptation to steal customers or capacity may be more than some competitors can resist. Indeed, we might even see one competitor seeking an advantage by disrupting their competitor's operations.

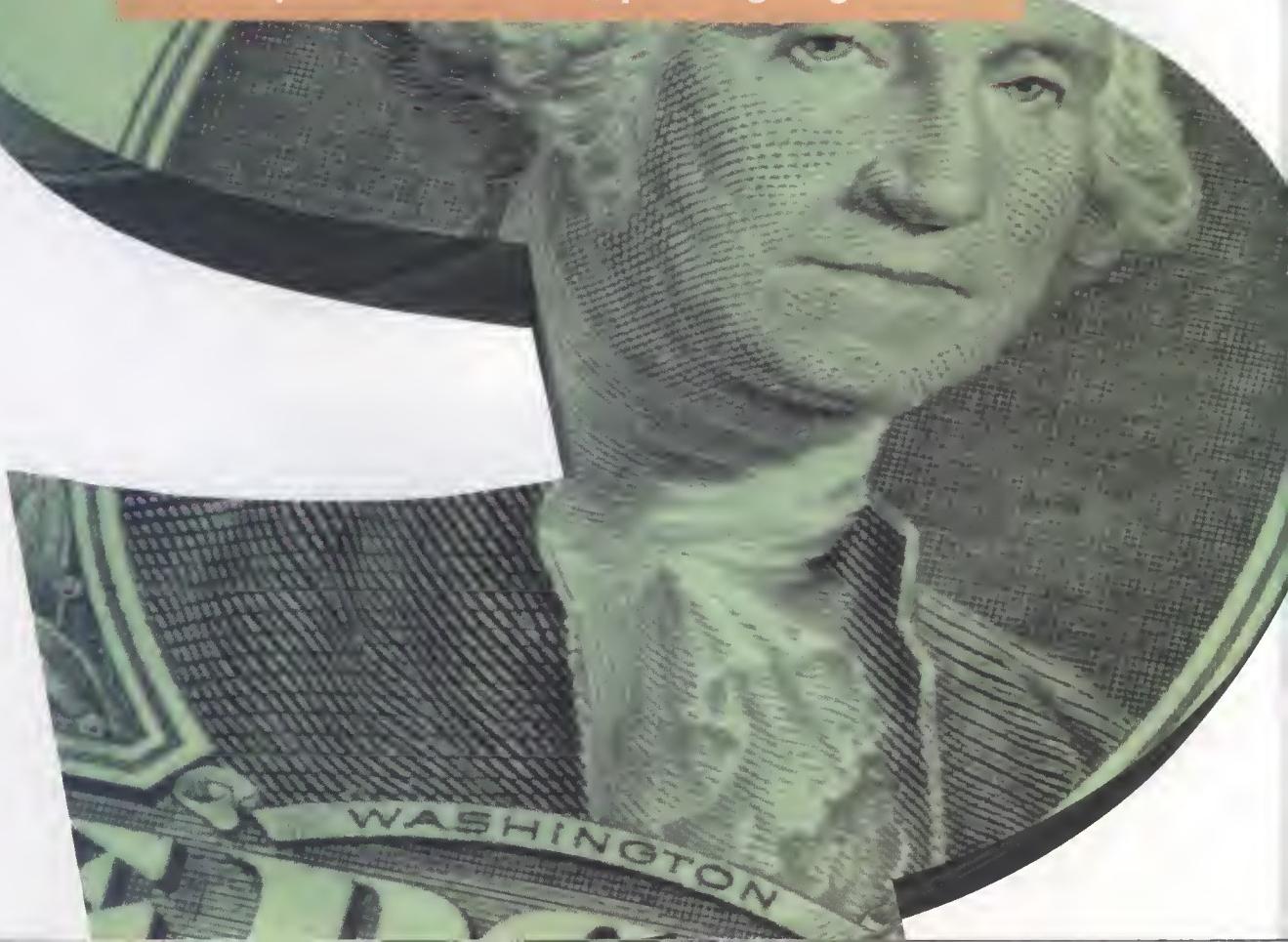
But the real risk may be more fundamental. Interoperability, which (despite some bad moments in the early 1990s) the industry takes for granted, is actually a fragile thing. It rests on standards which are set by standards bodies. The focus of those bodies may change as the communications industry further stratifies. One competitor may see

*continued on page S-10*

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no advantage to investing in standards or interoperability testing from which all the other competitors will benefit.

Unfortunately, interoperability failures may prove a greater risk to network assurance than natural disasters.

Finally, public policy decisions of the past few years present risks to network assurance.

The Telecommunications Act of 1996 requires established carriers to sell their

## Top Risks to the Network in the Next Decade

### Power

Without power to the central office (CO), there is no dial-tone. Recent "right sizings" have drained critical expertise in the nuances of power systems, power alarming, and the complexities of when and how to depower. Some telecommunications risk managers view this shortage of "brain-power" as a major emerging threat.

Removing power from a central office to reduce damage during flooding requires special training and procedures. Not removing power during a flood can increase the damage one hundred-fold. Staff reductions have lowered the number of personnel with this knowledge base and the authority to make the decision to "turn-off" a critical digital switch.

Another potential risk emerges when the time comes to restore power to the switch or facility. Development of clear, easy-to-follow procedures for de- and re-powering, plus contingency plans which clearly define who has authorization to request the removal of power, are critical to long-term reliability.

### Expertise

Experienced personnel can reduce risk and deal with potential outages before they become full-blown disasters. In some regions there are only two or three power engineers covering a large area. Recent "right-sizings" have created unfamiliarity with local systems, codes and unique requirements.

Gone are the days when there was one person available day or night that had worked in a building for over 20 years and who understood the wiring without a diagram, who knew when the last maintenance call took place and who had worked in the building that week. Reliance on paper and computerized records has increased the importance of scrupulous record-keeping, accurate documentation and the flow of information.

### Aging Infrastructure—Inside and Outside the CO

Aging roads, bridges, tunnels. The recent string of crumbling building and tunnel incidents in New York and the Chicago Loop flooding several years ago highlight the fact that the infrastructure in many large metropolitan areas is beginning to fail.

Some risk managers discuss the degradation of tunnels, conduits, roadways and buildings as the "sleeping giant" of risk management in the next decade. Facility and outside plant inspection programs, combined with diverse network routing can reduce the impact to customers.

### Evolving Network Architecture

The network is moving closer to the customer and service providers to large office parks may house their digital switches in huts or controlled-environment vaults (CEVs) near these properties. In many parts of the country, this trend of "dispersing the switching" or "moving the mainframe close to the customer" has resulted in a superconcentration of risk through central offices which are linked to numerous huts and CEVs.

Although monitored, personnel reductions can reduce response times to these remote switching sites when natural or man-made disaster strikes. A cut to the lifeline between host and remote switch can cut service and leave these businesses without communications services. Intelligent network design and implementation that minimize concentration of risks are the keys to avoiding business interruptions.

### Collocation—Real vs. Perceived Risks

Many companies deal effectively with collocation and have come to terms with the fact that it is here to stay. Risks can be managed through contractual and insurance arrangements, combined with adequate security precautions. Threats to customer data through the theft of computer drives or printouts can have major impact on your business. Careful data and physical security are the cornerstones of protecting customer data.

competitors equal access to their networks so those competitors can market telecommunications services using those networks. The Act also requires the implementation of local number portability (LNP)—the ability to change one's local phone company without changing one's phone number.

Then there are unbundling and collocation, which may be potentially greater threats than LNP. Collocation means that competitors must be allowed to physically locate equipment next to that of the established carriers with whom they're competing. Unbundling means that established carriers must offer to sell access to the fundamental building block services in their networks to competitive local exchange carriers (CLECs). For example, they must offer access to individual telephone lines, network control databases and network control functions.

Aside from differing views of the network, differing procedures for handling outages, and other complications, the mixing and matching of equipment and the exchange of control will place many more hands on critical parts of the network.

### Risk Analysis

Recognizing that numerous disruptive events are waiting to happen to a carrier's network, what now? While network

### Collocation Disaster Scenario: July 4, 2000

It's a hot summer day in downtown Metropolis. In a high-rise on Main St., an overworked air-conditioning unit begins to smolder. Smoke and flames spread through the risers of the building and damage the power cables to collocated equipment operated by Phone Companies X, Y and Z. Phone company X has leased collocation space to companies Y and Z. Building services provide temporary power units to supply power to company X, since they lease the space. However, due to the shortage of backup units, Companies Y and Z are without power for an extended period, lose service to their customers and begin lawsuits.

Who has priority for temporary power? Who is at fault? There are no simple answers to this scenario, but contracts, reciprocal agreements, discussions with facility management, and joint disaster planning exercises may have prevented the lawsuits.

disruptions cannot be made to go away, the risks associated with them can be managed. The first step is risk analysis.

Risk analysis is the quantitative assessment of risks. It demands that disruptive events are identified, that quantitative judgments about their impact are made (How many customers out? For how long? Costing how much money?), and the time it will take to recover is determined. Risk analysis demands that we think about which management strategies will reduce the probability of each event, by how much, and at a specific cost. Finally, risk analysis asks which investments in risk management will be the most effective,



One competitor may see no advantage to investing in standards or interoperability testing from which all the other competitors will benefit.



and what levels of risk can be expected in the new, evolving network.

To quantify risks, network managers must collect data about network reliability, predict the expected level of risk using computerized reliability models, measure observed risks, and interpret the difference between what is observed, what is expected and what is acceptable. If these steps are followed, we may have some surprises in store for us.

In an example which measures the cost of various risk management strategies against the actual reduction of risk, consider a carrier facing two alternatives. Alternative No. 1 costs \$90 million to implement a solution, reducing the risk by 3%. Alternative No. 2 costs \$2 million to implement and reduces the risk by 5%. In this real-life example, guess which alternative the carrier was using? Alternative No. 1! It was only after re-evaluation using reliable data and risk

management techniques that the carrier changed its mind in favor of the second alternative. Companies using such processes have saved as much as \$40 million. However, the process as applied to the current network is built on data and tools which don't exist for many network segments building interfaces to the PSTN.

Nonetheless, the current level of network assurance can be maintained as the network evolves. Communications carriers must begin by re-committing themselves to maintaining the strengths of the present network, and the present risk-management process. Those strengths are well-known: high availability of telecommunications equipment; robust telephone service and disaster recovery; established "best practices"; common industry objectives, and common industry standards for measuring reliability of performance. ■

## Risky Trends Accelerated by Competition and Deregulation

### **Outsourcing**

Network managers dread the sight of a contractor carrying a tool box into their CO. Competitive pressures have increased the trend to outsourcing maintenance, construction, and engineering functions. A spilled bucket of paint can cost \$200,000 if it lands on a processor shelf. A leaky core drill can easily destroy a bay of equipment with electrolytic corrosion. Clear, enforced methods of procedure (MOPS) and monitoring of activity can prevent these events from happening.

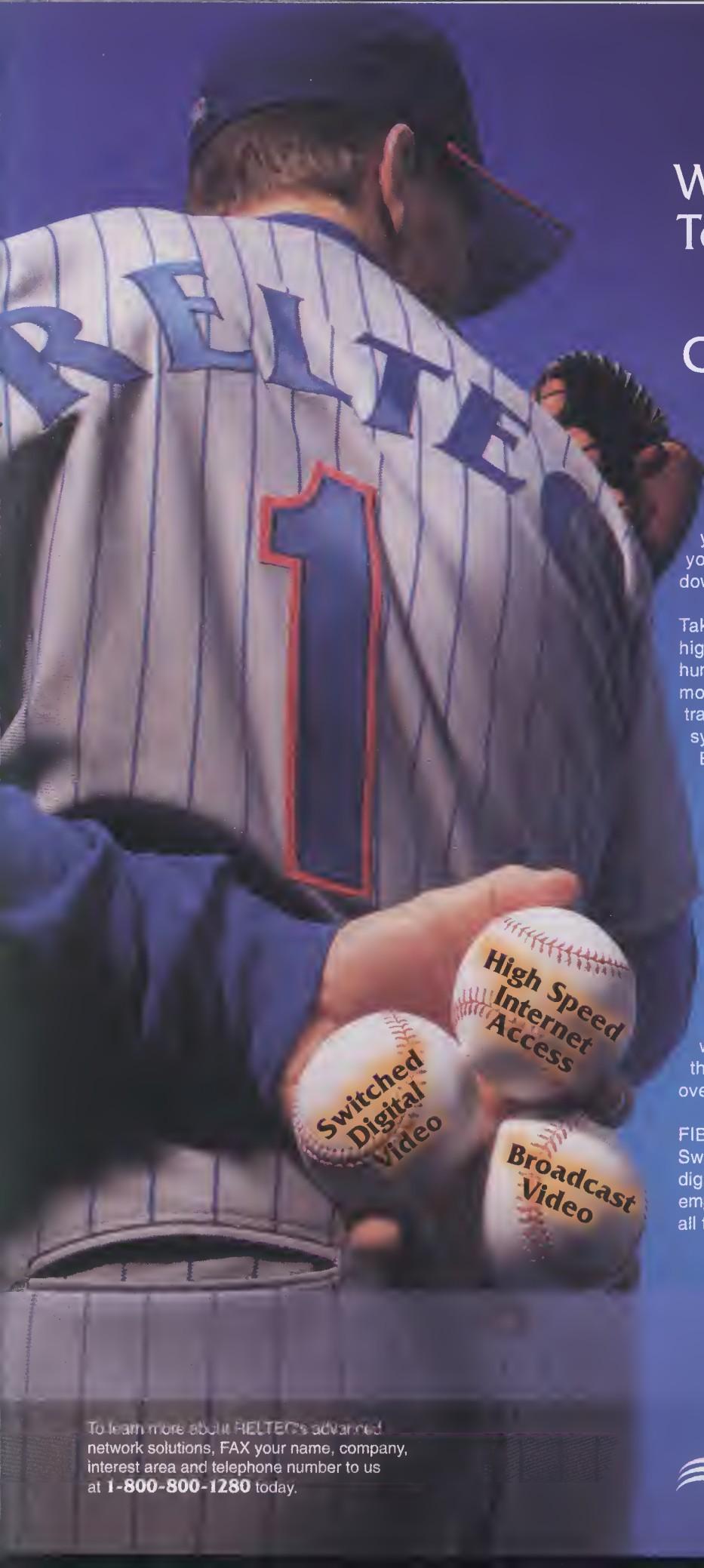
### **Mergers and Acquisitions**

Recent mergers and acquisitions may make the quantification and management of risk a challenge in these "combined" companies. Differences in climate, state, code and statutory requirements and unfamiliarity can color the way a risk is viewed and managed. For example, if a company in a warm climate purchases a provider in a snowy locale, they may have little or no experience with high-

pressure boilers or heavy snow loads and may view these risks as unremarkable. Knowledge transfer and objective assessment of risks internally, or by an objective third party, can reduce the likelihood of problems.

### **Accurate Assessment and Risk Management**

Risk management is essentially the identification of the assets that are critical to the revenue stream and the instituting of protection and loss control measures to maintain the flow of revenue. Understanding the revenue profile overlaying the network diagram may help to prioritize risks in an increasingly complex industry. If 30% of monthly revenue is generated through a single office park, then accurate risk assessment and protection measures at that location are a must. Is one service responsible for a higher proportion of revenue? Then plan for rerouting or have spare electronics available for restoring service.



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## RELIABILITY DURING EMERGENCIES

# Fool Them Once...

Disasters have made carriers more protective of their CDs and outside plant.



**By Annie Lindstrom**

Senior editor of *America's Network*.

Hurricanes, tornados, floods, earthquakes, mudslides, volcanic eruptions, ice storms, chemical spills, riots, fires, terrorism and hackers make for exciting Hollywood movies. They also add a considerable amount of spice to the daily operations of the nation's service providers. Preparing for "the inevitable" is a critical part of doing business when your service is the lifeline your customers will depend on when the rest of their world is crumbling around them.

There are two steps carriers and service providers can take to prepare for any type of disaster:

- Prepare employees by educating and training them; and
- Prepare the networks by building in survivable architectures, and comprehensive network management and emergency operations procedures and processes.

Carriers can accomplish both tasks by conducting training exercises that simulate emergencies, and by responding to actual emergencies and assessing their accomplishments afterwards. Proper and timely debriefing of teams that participate in simulated or actual emergencies sheds voluminous light on what procedures and processes work, and which processes can be improved. Lessons learned in both scenarios help mitigate problems that would not have come to light otherwise.

#### The Three Bears

There are three kinds of "disasters":

- Those that most certainly will occur, such as hurricanes, earthquakes or floods in areas prone to such events;
- Those that have the potential to occur

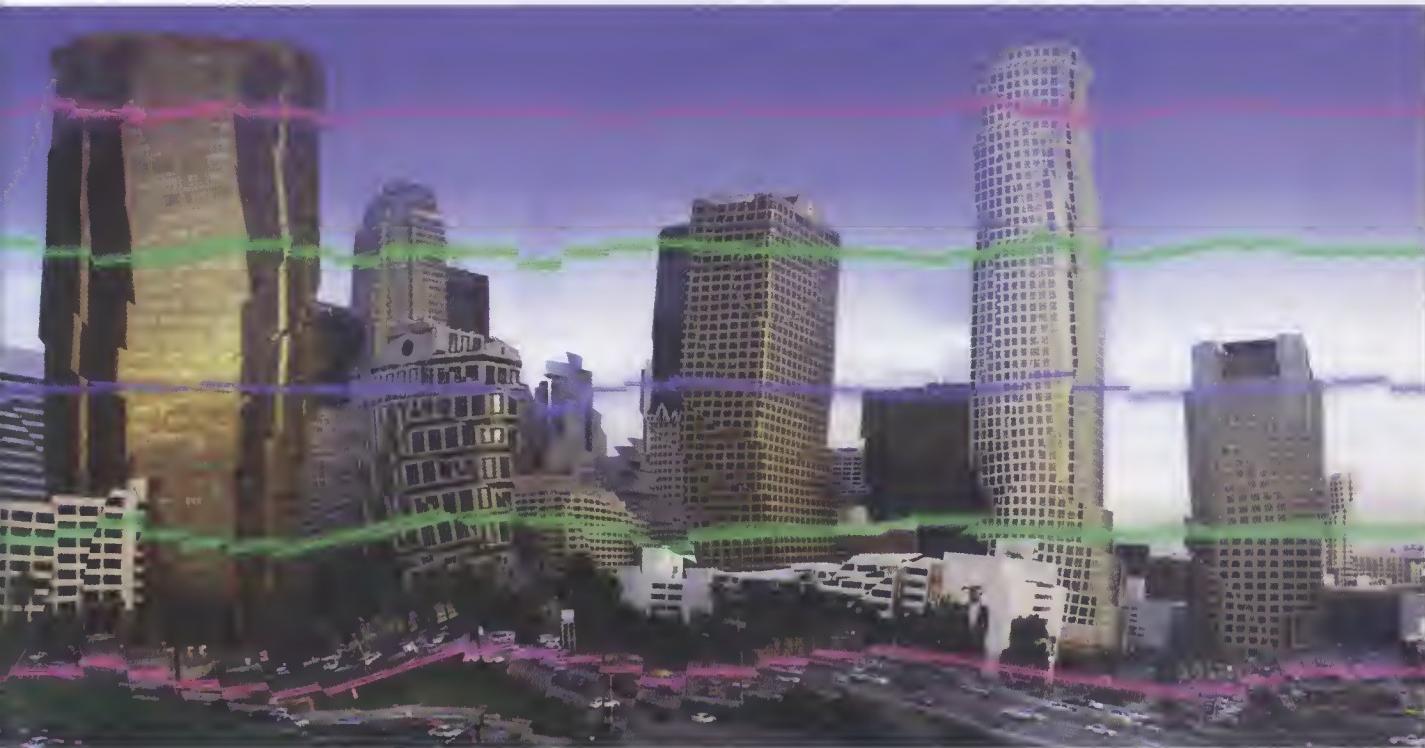
when events of great public interest, such as political conventions or a sporting event (such as the Superbowl), take place; and

- Those that would be nearly impossible for anyone to predict, such as the Chicago freight tunnel flood or the bombing of the World Trade Center.

Because there are so many different events that can qualify as a disaster or emergency, and because the scenarios they present can be affected by an infinite number of variables, many carriers find that it's fairly impractical to try to prepare for specific types of disasters.

"We could plan for every single contingency, but the cost factor becomes prohibitive," says Patrick Cowan, corporate disaster recovery supervisor for Teleport Communications Group (Staten Island, N.Y.). "A recovery is a recovery is a recovery. We train as a team to do our jobs in a compressed timeframe under pressure."

SBC Communications Inc.'s Pacific Bell subsidiary began preparing for disasters as "non-specific" events after the 1989 Loma Prieta earthquake, which was famous for interrupting that season's World Series, says Scott Grago, director of emergency



preparedness for Pacific Bell. "Since then, our approach has been to work on an all-hazards emergency plan. That is a plan that doesn't really distinguish between types of emergencies we may face. We respond the same way, no matter what the problem is," Grago says.

After the earthquake, Pacific Bell decided it needed a coordinated plan and management technique that touches all the organizations within the company whenever an emergency of great scope occurs, Grago explains.

True, in the late 1980s Pacific Bell was proactive in bracing its central office (CO) equipment to withstand severe jolts. However, in 1989, Pacific Bell's network did not have the route redundancy or "tunability" that is available today; nor did the company have its two network operations centers (NOCs) and two emergency operations centers (EOCs) in place. However, the NOCs and EOCs were operating when the Northridge, Calif., earthquake occurred five years later—and these centers played a key role in helping PacBell "tune around" affected areas of the network.

"Call volumes went up, but we responded and tuned the network so that

problems were transparent to our customers," Grago says.

After the 1989 Loma Prieta quake, Pacific Bell controlled and managed its network at the local level via roughly 50 switching control centers that typically monitored 15 to 25 central office switches each. "The idea for a network operations center that looked at the entire network was in its infancy in 1989, but the Loma Prieta quake renewed our emphasis on making sure that center came into being," Grago notes.

Pacific Bell now activates its 90-member EOC team when emergencies (or potentials) occur. The team, comprised of functional experts from every discipline in the company, runs through four training exercises annually. In addition, last month the EOC was activated to ensure that communications would remain secure and reliable during the Superbowl game in San Diego.

"For our purposes, an emergency is any event which jeopardizes our normal business operations. One of the tenets of emergency management is to mitigate potential problems before they rear their ugly heads," Grago notes. "We need to do threat assessment and look at potential problems we may be faced with."

**'A recovery is a recovery is a recovery. We train as a team to do our jobs in a compressed timeframe under pressure.'**—  
**Patrick Cowan,**  
**Teleport**

## ICE CREAMED



Bell Atlantic

The ice storm of the century, which ushered in the New Year in Bell Atlantic's upper northeastern states, will be forever frozen in the memory of those who experienced it.

The storm snapped 6,000

telephone poles and resulted in 90,000 trouble reports in a period of 10 days—three times the number of trouble reports Bell Atlantic typically deals with during the entire month of January. The bulk of the troubles? Drop lines taken down by falling branches. The most ominous problem? A hundred central offices in four states had to be placed on backup power, and 450 generators were powering subscriber loop carriers (SLCs).

Downed power lines surging up to 13,800 volts of electricity burned through six synchronous optical network (Sonet) rings. While the rings' self-protection features worked well, repairing the cuts fell into the hands of 3,000 regional technicians and 1,100 additional techs brought in from other states.

Bell Atlantic used 10,000-pound messenger cable to hold its aerial cable under heavy loads; this, along with the Sonet ring architectures, helped keep the network up and running during the storm, says Mark Brennan, executive director of operations for Bell Atlantic.

"We have never seen a storm like this before," comments Paulette Balich, operating vice president for upstate New York and northern states New England for Bell Atlantic. "We've only seen storms 10% to 20% the size of this one. But the emergency procedures we use to respond to them were what we used to cope with this one."

The storm was so impressive that Ivan Seidenberg, Bell Atlantic's vice chairman, and Lawrence Babbio, Bell Atlantic's chief operating officer, toured the scene Jan. 19—at which time both declared that they'd "never seen anything like it," according to the *Kennebec Journal Morning Sentinel*.

By Jan. 23, Bell Atlantic had replaced 3,000 cracked or downed poles. Replacement poles were shipped in from all over the nation by the suppliers scrambling to meet the unprecedented demand. In addition, Bell Atlantic's corporate outsourcing group gathered hundreds of generators to keep SLCs running while commercial power was crippled throughout the state of Maine—for up to 10 days, in many areas. The group also ordered ice spikes and snowmobiles for technicians needing help getting around the new hinterland.

When the storm was at its worst, Bell Atlantic's Watertown, N.Y., CO became home for 60 displaced residents for about a week. Hotel owners who'd closed their inns for the off-season returned from their southern getaways to accommodate out-of-state technicians.

Although the worst is over, trouble reports will be trickling in for awhile, according to Balich. Damage from the storm in the remotest areas is likely to come to Bell Atlantic's attention when warm weather arrives and people return to the state for the spring and summer tourist season.

—Annie Lindstrom

## Gas attack

Earthquakes aren't the only kind of disaster faced by carriers—some hazardous situations are man-made. Last fall, a truck carrying corrosive gas crashed into an Ameritech CO in Arlington Heights, Ill.—or at least it seemed that way. The regional Bell operating company (RBOC) was simulating a hazardous situation as part of its emergency preparation drill, according to Joe Luby, general manager of network reliability and security for Ameritech (Chicago).

Dry ice and green Kool-Aid were used to add authenticity to the exercise. About 90,000 customers were "affected." As part of the exercise, Ameritech personnel were required to clean and replace contaminated equipment that was damaged in the crash; plus, they had to notify other carriers that had equipment collocated in the CO. Ameritech also involved its switch equipment supplier, asking how long it would have taken to get a new switch delivered and turned up if the whole switch had had to be replaced, Luby explains.

Lessons learned in actual disasters also have helped the RBOC respond quickly and efficiently when these events reoccur, Luby adds. For example, Ameritech changed its tornado damage assessment approach after twisters leveled the town of Plainfield, Ill., in the early 1990s. Instead of responding to trouble on a customer-by-customer basis as it did in Plainfield, Ameritech now assesses a stricken area as a whole by walking through it and surveying the damage after the power company declares that it is safe to do so, according to Luby. This updated procedure was used effectively after tornadoes struck the Detroit area last summer, he adds.

Preparing for potential emergencies can lead to some pretty interesting procedures. To keep its facilities safe during the 1996 Democratic Convention in Chicago, Ameritech welded shut the manhole covers surrounding the United Center for the duration of the convention, Luby notes. The RBOC also tightened security considerably during the

*continued on page S-18*



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To keep its facilities safe during the 1996 Democratic Convention, Ameritech welded shut the manhole covers surrounding the United Center.

convention by requiring employees who worked in key buildings to provide separate identification for access.

#### Mergers and mutual aid

As competition increases, equipment from all sorts of service providers will be collocated in COs and remote terminals. This requires a great amount of coordination and cooperation among traditional competitors. In addition, incumbent local exchange carriers (ILECs) that buy transport from one another have a vested interest in ensuring that their providers have reliable, secure networks.

"We are all dependent on others to help us get our services out there," Cowan says. "It is our responsibility to make sure that their emergency preparedness plan is sufficient to recover in the same manner as ours is. We extended mutual aid agreements to our vendors that tell them that our resources are available to them when they need help solving a problem."

Carriers can share information with one another concerning best practices and procedures in industry groups such as the Network Operations Forum and the Cable Awareness Forum, says Adrian

VanBourgondien, senior manager of transmission, surveillance and restoration management for MCI. "Years ago, there we had lots of aerial cable and cable that was buried was direct buried and uncovered," VanBourgondien says. "We are much stricter about how we put cable in the ground today. We bury it much deeper. There a lot of things we did with fiber yesterday that we don't do today."

MCI is also making an effort to diversify its points of presence in major cities such as New York and Los Angeles. "A few years ago, 60 Hudson St. in New York was our biggest site in the city; we've diversified quite a bit now. That is taking place industry wide," he adds. "What drove that was the World Trade Center bombing."

The Mississippi River flooding in 1993 served as a wake-up call. After seeing other carriers' sites in jeopardy, MCI began to focus on what might happen if one of its sites were to "drown." According to VanBourgondien, MCI eventually built

containers that can be shipped to locations at a moment's notice; four trailers containing plug-and-play fiber regeneration and multiplexing equipment await the call for help at MCI's Richardson, Texas, engineering facility.

"The Hinsdale CO fire is still fresh in everyone's memory," VanBourgondien recalls. "It's the industry's best example of what can happen if you don't pay attention to best practices, diversity and survivability. You have to accept the fact that you can't single-thread yourself."

#### The new industry

Network reliability is likely to improve as network consolidation takes place. "Mergers will make the network more robust, stronger and easier to control," Cowan notes.

The need to provide customers with reliable service in spite of emerging competition has led to the creation of mutual-aid agreements between carriers. "In California, we have tried to move away from the competitive environment in emergency management and share information among the other large players," Grago says. "I've seen a tremendous amount of information flow between large companies under the banner of the National Telecommunications Association."

One brilliant idea, according to Grago, is the generator jack, which allows a carrier to roll a generator to the outside of a CO and plug it into an AC tap box. Pacific Bell has retrofitted all of its COs with generator jacks, as many carriers are doing today.

While it's true that no carrier wants disasters and emergencies to happen, they do. It's also a fact that when they do, their employees enjoy working at a heightened pace and sense of urgency that they engender. "They dig it. They like it and get excited. Their adrenalin starts flowing and they get into solving the problems they face," VanBourgondien says.

Although NOCs and surveillance equipment are used, humans are the most important resource a company has when a disaster occurs. "There is no substitute for the human being when responding to an emergency," Luby notes. ■

## RELIABILITY DURING EMERGENCIES

# Dealing With The Devil

Hackers pose no small threat to service providers, as their tools, methods and ranks grow larger and more effective each day.



By David Kopf

Managing editor, Internet editor and Web editor of *America's Network*.

A pasty-faced, disaffected 13-year-old who enjoys Metallica and video games hacks her way into an unused maintenance port at a LEC central office (CO) to listen in on her teachers' phone conversations.

A member of a foreign terrorist organization logs into a carrier's internal network via a stolen passport and, at a precise moment, shuts down the SS7 network for the entire U.S. eastern seaboard.

What's the similarity between these two scenarios? They're both entirely possible—it's just that incidents like the former have already happened, and a disaster like the latter might be an inevitability. Public network providers must prepare for both.

"On a national level, the whole issue of how vulnerable society is to a sophisticated attack on the network is not really fully appreciated," says Robert Rosenberg, president of The Insight Research Corp. (Parisippany N.J.). "With the introduction of software, a bug or a worm, we could imagine any number of different scenarios for essentially bringing down the signaling network, which means bringing down the POTS [plain old telephone service] network. The cost of that type of an outage would run into the trillions of dollars each day."

"If you really want to do serious damage, don't send a bunch of fanatics with a bomb to the Trade Center, stop the Trade Center and every downtown area in the United States by planning and

pulling off a sophisticated attack on the telecommunications network," Rosenberg adds.

That network may not even know what hit it; it took weeks just to figure out the basics of what caused AT&T's network to crash in 1990. Although



carriers are well aware of the threats, for all their security assets, they aren't always able to protect themselves.

### The problem with being huge

Local exchange carriers (LECs) are large organizations with many resources, including security; however, coordinating all those resources can nearly impossible, which creates an atmosphere conducive to security leaks, says Toni Ames, senior consulting project manager at Coral Systems (Longmont, Colo.). Ames has spent more than 15 years investigating hackers.

"Corporate America, especially in the telecommunications industry, has changed drastically," Ames says. "The downsizing problems, the accountability problems—they've left themselves wide open. I'm afraid something's going to be missed. I've seen corporations that haven't even taken the time to audit their own equipment. It's real scary."

With a huge number of devices, people and systems to inventory, LECs might miss a dial-up maintenance number here or an internal channel there. Unfortunately, what a LEC misses, a hacker might find. Although dial-up ports may help vendors and carriers troubleshoot, repair and upgrade systems, they also provide a possible point of compromise. Like mythological dragons, the living, breathing PSTN has chinks in its armor. If hackers can get the password to that port (find the chink), they can get in.

### Leaving the front door open

For some reason, many network managers place security at the bottom of the priority list. According to Dale Drew, senior manager of security engineering for internetMCI (Washington), there are many unsecured systems dangling like low-lying fruit that even the dimmest hackers can pluck off the vine and infiltrate.

"Brute force hacking or using commonly exposed systems is the No. 2 way [to infiltrate a network]," Drew says.

**Although dial-up ports may help vendors and carriers troubleshoot, repair and upgrade systems, they also provide a possible point of compromise.**

"That's pretty much where a hacker will finger a system, Telnet to that system and then log in a [fake] password.

"We were working with a tier-three [Internet] service provider," Drew recalls. "The bad-guy was modifying that provider's DNS server, repointed one of the Web pages to his home, collected a name and password, and then got access to the ISP."

If hackers are forced to finesse their way into a server, Web sites are often the first they will attack, because it might lead to bigger, better hacks, according to Drew. "We see a fairly steady increase in computer hackers getting access to systems over the Internet, mostly through Web pages," he says. "The hackers break into the system. They'll get access to the Web page, install a sniffer, watch customers log in or log out of the system, and collect names and passwords. This gives them access to that enterprise. [They] then stay within the systems, collecting data, uploading software and things of that nature. Then, when they get bored with it, that's when they usually modify the Web page."

This is a great cause for concern for tier-two and tier-three ISPs, Drew says, because they either do not have the resources to protect their systems, or they don't have the knowledge base or motivation.

### Assuming a pleasing face

The main way hackers compromise networks is not through detailed knowledge of computer science, but more through social engineering—the non-computer methodologies hackers use to get passwords or the location of unused maintenance ports. Social engineering covers everything from petty theft to all-out fraud and confidence schemes; diving through dumpsters to dig up printouts detailing sensitive information, or simply misrepresenting themselves as 'fellow personnel' to carrier staff are easy (and reportedly

successful) methods. Fast-talking an operator is a favored way to do it as well.

"Social engineering is pretty much the No. 1 way service providers are getting hit," Drew says. In one case, a computer hacker called into an LEC at 3 a.m., pretending to be an operator. He convinced the other operator to call-forward an internal dial-up line belonging to an ISP to hacker's home.

"The hacker then pretends to be the ISP, and puts up an interface stating something along the lines of "welcome to the internal network, please enter your user ID and password," Drew continues. "When an internal ISP employee types in his name and password—thinking he's on the real system—the hacker has access to the technician's name and password."

Apparently, it doesn't take much to beguile carrier personnel, either. Playing dumb can work just as well as a confidence game. Ames once was called to a police station in Washington state because a 14-year-old boy had disconnected the telephone service of his neighbors.

"What we found out," Ames says, "is that the telephone company had been in the process of switching over to a new switch. This young man told the folks in the central office that he wanted to be a phone man when he grew up." LEC staffers took the boy under their wing, letting him borrow company manuals to learn more about the trade and technology. He did so—for all the wrong reasons.

"He figured out how he could get in a switch," Ames says. "He also knew exactly the time of the cutover [to the new switch], because in the coffee room they had posted a notice for a cutover party. So at 12:38 in the morning, he used a small, archaic computer to get in the system and was building himself a new line as well as disconnecting other lines."

A popular way for hackers to gain entry is to misrepresent themselves as consultants for the year 2000 (Y2K) bug, Ames says. Once they're in, they might find access to sensitive information. "Basically, every hacker that I investigated yesterday is in a Y2K consulting position today, except for one—and he's

*continued on page S-24*

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**Not only does consulting on issues such as the Y2K bug pay well, but so does working for IT temporary agencies, especially since many fail to perform background checks or look at accreditation.**

running an Internet porn business out of Seattle. He's going to make about \$22 million this year."

Hackers over 18 soon realize they can be charged with felonies for their computer crimes, so they throw on a suit and tie and look for legitimate computer work. Not only does consulting on issues such as the Y2K bug pay well, but so does working for IT temporary agencies, especially since many fail to perform background checks or look at accreditation, Ames says. Many hackers plainly misrepresent themselves to attain LEC employment, and access to security information.

Carriers should require prospective employees to sign off on background checks. In addition, prospective employers can outline the job-interview process to sniff out hackers trying to pass themselves off as genuine job seekers more easily. "Make sure you know who you're hiring, don't hesitate to do background checks, look at every service available out there that can assist you in this process, and if you're asking someone for personal information, make sure you verify it," Ames advises.

### **Sucking the life out of networks**

For ISPs in particular, the major threats may have nothing to do with clever intrusions or secret-agent-type finesse. In fact, they may be downright prosaic. Many ISPs are concerned about network misuse that gobbles up network resources and frustrates paying customers.

"I think the two major issues that ISPs are going to be dealing with [in the next year] are denial of service [DoS] and spam attacks, because they affect so many users so quickly," Drew says. "There's an amazing amount of resources required to not only look for those threats, but also to respond to them and stop them."

In DoS attacks, hackers use tools like Smurf or SYN attacks via freeware (widely distributed on the Internet) to throw a constant barrage of requests to a given server. The server must then address the seemingly endless queue of requests before it can get to any others, thus effectively shutting down the site to any other users. Further confounding the server is the fact that DoS attacks employ a false return address, stymieing its efforts to address the requests.

We're actually seeing two very interesting [DoS] categories," Drew says. "We're seeing a pretty large white-noise category, where all these kids go out to a search engine, download [DoS] programs, and pick a victim and attack him because they're either ticked off with him or they want the notoriety. But we're also seeing a lot of competitor attacks where we're seeing Web providers almost specifically attacking each other...to get a competitive edge."

Drew recalls two Web hosts, who were internetMCI customers, that attacked each other in hopes of advertising the other's degraded service. "Web Provider A, who was about two blocks away from Web Provider B, called us up and said 'Help me, I'm being



attacked! Provider B called up about two seconds later and said 'Help me, I'm being attacked!' They were actually attacking each other," he says.

To fight DoS attacks, MCI monitors the amount of traffic coming into customer interfaces. When traffic peaks or grows fairly significantly, MCI knows that either the customer is doing more business than it usually does, or the network is under a DoS attack. When users call in an attack, MCI activates a program called DoSTracker (a free program available from MCI—visit [www.securitymci.net](http://www.securitymci.net)) on the router that connects MCI to the customer. The carrier uses DoSTracker to analyze packets going to the customer, scanning for DoS attacks.

"Programs like DoSTracker are pretty important, because in a [DoS] attack, all the packets that come from the bad guy are forged," Drew says. "So you're not sure exactly where the packets come from, unless you go router-by-router through the network until you find the source. It used to take us about 20 minutes to do this manually. Now, with DoSTracker, it takes us two or three minutes."

Spam attacks come from online marketers e-mailing millions of unwanted advertisements and solicitations to users. The shotgun approach (named for its resemblance to the likely outcome when one tosses a slab of Spam at an electric fan) not only disgruntles dial-up users who must download these e-mails, but ties up ISP mail servers and network bandwidth.

Spammers are usually difficult to track, because their usual *modus operandi* is to create a phony, one-time e-mail address using an ISP's free-trial diskette or through a free mail service (such as HotMail), blasting out their gigantic e-mail broadcast; and then deleting the account.

"There's a significant return on investment for these guys," Drew says. "All they do is plop down \$400 to get a

mailing list and a program, and they make x-number of dollars per message. So there's a significant amount of motivation behind it."

The culprits are becoming increasingly difficult to catch. "Spamming is becoming a significant resource strain," Drew says. "One guy with a laptop can send 7 million e-mail messages in two hours and then disappear—and the ISP is left to answer complaints from 7 million very angry people. But the spammers are becoming much more knowledgeable about the legal system. So not only do we have to have technicians that are scanning for violations of [spamming] policy and respond to complaints, but we now have a fairly large number of legal folks in ISPs who are dealing with the morass of identifying spammers and making them stop."

Even then, spammers are becoming wiser to ISP legal might. Spamming organizations can start two or three companies; the spammer could be a customer of the company or the company of the company, according to Drew. "So, when we send a mail to the spammer saying 'Stop this,' they say, 'Don't talk to me; talk to company X,' which [in turn] says, 'Talk to company Y.' By then, it's four months later."

In the future, ISPs might be able to rely on legislation or legal precedent to combat spamming—for example, unsolicited faxes are illegal, because it costs money for the user to receive the fax. Until then, ISPs will be forced to detect, trace and enforce their own acceptable-use policies. MCI's policy can be found at <http://www.mci.com/aboutus/company/corporate/consumer/span.shtml>. But when spammers use stolen credit cards to create multiple accounts, send out millions of e-mails and then disappear, these policies become almost pointless. "It's very difficult to enforce the policy, because the spammer knows what the policy is, is violating it anyway and doesn't care,

**Discussions of hacking techniques or developing hacking software are activities protected under the First Amendment.**

because the account will disappear in a day," Drew explains.

### **Fighting the software front**

DoS tools, bulk e-mail software and more esoteric hacking programs are easy to obtain. Hackers are becoming more organized, and hacking is becoming much easier.

"What's interesting is that the attacks that we've seen that are related to hackers breaking into systems have remained fairly constant. [However], their methods and behaviors have changed, because hackers are getting access to interactive chat boards and sharing information in real-time, as opposed to socializing on bulletin board systems [BBSs]," Drew says.

Now, he continues, "hackers are becoming much more loner types, and much more devious as a result, because they have no need to be part of a social clique. So we're seeing hackers stay in computer systems for three to four months at a time as opposed to a week, and sharing their password on the BBSs."

Chat rooms provide education on compromising systems. In addition, hackers can obtain a variety of software tools to help them make mischief. Hackers have access to a cornucopia of dangerous applications they can easily download from BBSs or even Web pages.

"The reason why things like social engineering [and] brute-force hacking are so easy to do are because these tools are so easily accessible on the network," Drew says. "You no longer have to be associated with large social cliques of computer hackers to ween your way up to the point where all the people with all the knowledge will share it with you. Today, it's all online."

"If you go to Yahoo! and say, 'I want to learn how to hack,' you'll get a return of 150 Web pages that provide computer programs that you can download and hack from day one—with knowing anything about the system," Drew continues.

Easy access to easy hacking programs is generating a larger, younger crowd of hackers. "All of these 13- and 14-year-old kids with all the emotions and hormones that come with them are attacking these Web pages, deleting file systems, putting graffiti on the Web pages and things like that," Drew says. "These tools are so accessible on the network that anyone with any skill level can download them and wreak havoc on the network and be fairly invisible."

Why are such software tools easy to obtain, and how do online hacker forums exist in the first place? Free speech. Discussions of hacking techniques or developing hacking software are activities protected under the First Amendment.

"A lot of the folks in the industry have fought to make these programs illegal," Drew says. "Unfortunately, where the law stands today possession of the tool is not illegal, but use of the tool is." Legalities mean nothing to organized hackers with more serious intentions than hacking a Web page. Seriously compromising the public network would require hackers to pack heavier computing punch, according to Insight Research's Rosenberg.

"I don't think that most freeware is going to bring down the telecommunications network," Rosenberg says. "I think that the level of sophistication required would probably be that of a foreign power or a substantial group of very sophisticated people with a lot of funds and a lot of computing horsepower to create the kind of bug that would be necessary to bring down the signaling network."

Most hackers do what they do simply for the notoriety and not much else. Until a time when terrorists crash the PSTN, most hacking will be the result of mischief rather than outright political malevolence. "For the most part, it's people who want to make the claim that they're the one that did this," Drew says. ■

## RELIABILITY DURING EMERGENCIES

# Making Software Trustworthy

By Lawrence Bernstein and C.M. Yuhas

Lawrence Bernstein is president of the National Software Council and is a recognized expert in software technology, project management, network management and technology conversion. He consults through his company, Have Laptop-Will Travel, and is the executive technologist with Network Programs Inc., which builds software systems for managing telephony services. Bernstein was an executive director of AT&T Bell Laboratories, where he worked for 35 years.

C.M. Yuhas is a freelance telecommunications writer who has published several articles for IEEE publications.

Do you lose data when your software system crashes and comes back up again? Too often, the answer is yes. As people come to depend on systems for their livelihoods and sometimes for their very lives, software must be made to behave reliably.

Software is fundamental to computerized systems, yet it is rarely discussed as an entity whose quality can be controlled with specific techniques. This technology on which systems are built has itself got a weak theoretical foundation. Until some difficult questions can be resolved to provide that foundation, constraints can be placed on software design to deliver a more trustworthy product.

Most software theory focuses on its static behavior by analyzing source listings. There is little theory on its dynamic behavior and its performance under load. Often, we do not know what load to expect. Vinton Cerf of MCI (and inventor of the Internet) has remarked that "applications have no idea of what they will need in network resources when they are installed." As a result, we try to avoid serious software problems by over-engineering and over-testing.

Software engineers cannot ensure that a small change in software will produce only a small change in system performance. Industry practice is to test and retest every time any change is made

in the hope of catching the unforeseen consequences of the tinkering. The April 25, 1994, issue of *Forbes* pointed out that a three-line change to a 2-million line program caused multiple failures due to a single fault.

There is a lesson here: It is software failures, not faults, that need to be measured. Design constraints that can help software stability need to be codified before the industry can hope to deliver reliable performance. Instabilities arise in the following circumstances:

- Computations cannot be completed before new data arrive;
- Rounding-off errors build or buffer usage increases to dominate system performance eventually; and
- An algorithm embodied in the software is inherently flawed.

Six constraints can be imposed on software development that will help prevent the above circumstances. Although more study of design constraints is needed, that's no reason to neglect what can be done.



## SOFTWARE REJUVENATION

Instead of running a system for a year, run it one day, 365 times.

- Periodic preempted rollback of continuously running applications prevents future failures.
- Gracefully terminating an application allows restarting at a known, clean and internal state.

### **Software rejuvenation**

The first constraint is to limit the state space in the execution domain. Today's software runs non-periodically, which allows internal states to develop chaotically, without bound. Software rejuvenation is a new concept that seeks to contain the execution domain by making it periodic. An application is gracefully terminated and immediately restarted at a known, clean, internal state. Failure is anticipated and avoided. Non-stationary, random processes are transformed into stationary ones.

One way to describe this is as follows: Rather than running a system for one year with all the mysteries that untried time expanses can harbor, run it only one day, 364 times. The software states would be reinitialized each day process by process, while the system continued to operate. Increasing the rejuvenation period reduces the cost of downtime but increases overhead. One system collecting on-line billing data operated for two years with no outages on a rejuvenation interval of one week.

A Bell Laboratories experiment showed the benefits of rejuvenation. A 16,000 line C program with notoriously leaky memory failed after 52 iterations. Seven lines of rejuvenation code with the period set at 15 iterations were added and the program ran flawlessly. Rejuvenation does not remove bugs; it merely avoids them with incredibly good effect.

### **Software Fault Tolerance**

Each software process or object class should provide special code that recovers when triggered. A software fault-tolerant library with a watchdog demon can be built into the system. When the watchdog detects a problem, it launches the recovery code for the application software.

In call processing systems, this usually means dropping the call but not crashing the system. In administrative applications, in which keeping the database is key, the recovery system may recover a transaction from a backup data file or log the event and rebuild the database from the last checkpoint. Designers are constrained to define the recovery method explicitly for

each process and object class using a standard library.

### **Hire Good People and Keep Them**

Today, there are more than 100,000 openings for skilled software engineers; this will grow to 600,000 by the turn of the century. One small company projects an average of 16 weeks to bring someone up to speed—8 weeks to fill a job and another 6 to 8 weeks to train the new hire in the ways of the company. This is not news, but the high correlation between defects in the software product and staff churn is chilling.

George Yamamura of Boeing's Space and Defense Systems reports that defects are highly correlated with personnel practices. Groups with 10 or more tasks and people with three or more independent activities tended to introduce more defects into the final product than those who are more focused. He points out that large changes were more error-prone than small ones, with changes of 100 words of memory or more being considered large. This may have some relationship to the average size of human working memory.

The high .918 correlation between defects and personnel turnover rates is telling. When Boeing improved its work environment and development process, the company saw 83% fewer defects, gained a factor of 2.4 in productivity, improved customer satisfaction and improved employee moral. Yamamura reported an unheard-of 8% return rate when group members moved to other projects within Boeing.

### **Limit the Language Features Used**

Most communications software is developed in C or C++ programming languages. Les Hatton's book, *Safer C: Developing Software for High-Integrity and Safety-Critical Systems* (ISBN: 0-07-707640-0), describes the best way to use C and C++ in mission-critical applications. Hatton advocates constraining the use of the language features to achieve reliable software performance.



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## SOURCES OF FAILURE

- Poor Algorithms
- Missing deadlines
- Buildup of Roundoff Errors
- Memory Leaks
- Broken Pointers
- Bad Register Use

"The use of C in safety-related or high integrity systems is not recommended without severe and automatically enforceable constraints," he writes. "However, if these are present using the formidable tool support (including the extensive C library), the best available evidence suggests that it is then possible to write software of at least as high intrinsic quality and consistency as with other commonly used languages."

For example, a detailed analysis of source code from 54 projects showed that once in every 29 lines of code, functions are not declared before they are used. C is an intermediate language, between high level and machine level. There are dangers when the programmer can drop down to the machine architecture, but with reasonable constraints and limitations on the use of register instructions to those very few key cases dictated by the need to achieve performance goals, C can be used to good effect.

The alternative of using a high-level language that isolates the programmer from the machine often leads to a mix of assembly language and high-level language code which brings with it all the headaches of managing configuration control and integrating modules from different code generators. The power of C can be harnessed to assure that source code is well structured. One important constraint is to use function prototypes or special object classes for interfaces.

### Module Size and Memory

The optimum module size is 300 to 500 instructions. Smaller modules lead to too

many interfaces and larger ones are too big for the designer to handle. Structural problems creep into large modules.

All memory should be explicitly initialized before it is used. Memory leak detection tools should be used to make sure that a software process does not grab all available memory for itself, leaving none for other processes. This creates gridlock as the system hangs in a wait state because it cannot process any new data.

### Reuse Unchanged

A study of 3,000 reused modules showed that changes of as little as 10% led to substantial rework—as much as 60%—in the reused module. It is difficult for anyone unfamiliar with a module to alter it and this often leads to redoing the software rather than reusing it. For that reason, it is best to reuse tested, error-free modules as is.

Software developers know that their systems can exhibit unexpected, strange behavior, including crashes or hangs, when small operational differences are introduced. These may be the result of new data, execution of code in new sequences or exhaustion of some computer resource such as buffer space, memory, hash function overflow space or processor time. Fixes and upgrades create their own errors. The fact that the only recourse has been exhaustive re-testing limits the growth of software productivity in enhancements to existing systems and modules. Experienced software managers know to ask "What changed?" when a system suddenly and catastrophically fails.

The point is that feedback control theory must be the watchword of software professionals if trustworthy software systems are to be a reality. One way to do this is to constrain the dynamic behavior of software by following design rules. The problem is that we do not have the all rules we need. Even NASA, which creates the best software in the world, must admit to 11 mission failures due to software defects. That's not good enough. ■





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SHIRA LEVINE

# The dazzle of digital

## PCS carriers pull out all marketing stops—despite network limitations.

P

ICTURE THIS SCENARIO: YOU WANT TO BUY A NEW CAR. MAYBE YOUR OLD CAR JUST DOESN'T GO FAST ENOUGH ANYMORE, OR IT KEEPS BREAKING DOWN AT INOPPORTUNE TIMES, OR IT JUST DOESN'T HAVE ALL THE BELLS AND WHISTLES, LIKE A CD PLAYER AND POWER WINDOWS.

So you go to the car dealership and check out what they have. There's a bright red convertible with every single feature imaginable—power everything, leather interior, a V-6 engine and an alarm system. It's a little more money than you wanted to spend, but given everything that comes with it, it's a great deal.

But just as you're about to pull out your checkbook, the salesman tells you there's just a slight hitch. You can drive the car around your area all you want, but once you get a certain distance past city limits, all those amazing features disappear. The car may still look cool, but the power locks and windows don't work anymore, the CD player is useless and the alarm won't arm itself. And you can't go any faster than 35 miles an hour.

The salesman assures you that at some point in the future, that will change and you'll be able to drive your car everywhere without any difference in quality. But he can't say when exactly that will happen.

Would you still buy the car? Maybe, maybe not, depending on your driving habits. If you like to take frequent road trips, it wouldn't be worth it, but if you spend most of your time tooling around town, you might still plunk down your money.

That's exactly what personal communications service (PCS) providers are counting on—that despite the limitations on PCS service today, there will be enough consumers who are dazzled by

digital and don't care much about coverage holes.

Quality's great—just don't move.

The holiday season is a natural time for wireless service providers to up their advertising efforts. What better gift for a loved one than a phone? But it was the first holiday season since the initial wave of PCS providers began rolling out their service, making last December's wireless advertising blitz particularly intensive. For PCS carriers, it was a major opportunity to differentiate themselves from the incumbent cellular providers in the market.

"Customers are going into a retail store, and now there are three or four wireless companies, instead of two," says Gail Fraser, director of wireless enterprises at Andersen Consulting

(McLean, Va.). "It's confusing for them, and it's going to be even more confusing in six to nine months when there are up to 12 carriers, each asking the consumer to make a selection."

Adding to the confusion is the current status of the majority of PCS carriers. Digital technology enables features such as Caller ID, e-mail and alphanumeric paging—as long as the user stays within one of his carrier's service areas. If a customer travels to another service area where his carrier has a roaming agreement with another PCS or digital cellular carrier, he can still get most of his features. With a dual-mode phone, he can at least get analog service in most parts of the country. Without that phone, however, he's out of luck.

"The coverage limitations mean that PCS might not be the right deal for some potential consumers," Fraser says. "It's not for the road warrior who needs to drive across five or six states on a regular basis."



PCS marketing? Try direct PCS marketing—such as retail PCS sales outlets like the above AT&T Wireless Services wireless service storefront, which sells suites of AT&T products.

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**STARTING FROM SCRATCH**

But Fraser believes that PCS carriers are savvy enough in their marketing efforts to identify their most likely potential customers and focus their attentions there.

"The PCS industry is just 2-years-old, so naturally it's going to have a lot of pockets that aren't yet covered," she says. "They recognize that and they're up front about it, and about not comparing themselves apples to apples with cellular."

One major advantage that PCS has over cellular is that the service providers can start with a clean marketing slate. "From a marketing and sales perspective, we have taken everything from the cellular world and thrown it out the window," says a spokesman for Sprint PCS (Kansas City, Mo.).

Cellular service has a history of being local in nature and has been characterized by service contracts, activation fees, roaming charges and a range of airtime charges, depending on the time of day. PCS providers, on the other hand, are steering clear of all that and offering incentives such as the first minute of incoming or outgoing calls free, flat-rate roaming charges, no long-distance charges and pre-pay options.

"We're really trying to rise above the clutter," says Jim Robertiello, general manager of Omnipoint New York.

"We've positioned ourselves in the market as a straight, honest deal to the customer, where there's no fine print at the bottom of our ads."

Many PCS carriers are also touting their expanded coverage areas. For example, while the coverage area for Cellular One in Chicago is limited to the city and its outlying areas up to an hour-and-a-half away, PrimeCo owns licenses throughout the Midwest, meaning that customers can travel as far north as Milwaukee, and by the end of the year up to Green Bay without incurring roaming charges. In addition, a PCS customer can use his phone in other cities where his carrier has a network without paying roaming fees.

International roaming is another area where some PCS carriers are making a

**'We've positioned ourselves in the market as a straight, honest deal to the customer, where there's no fine print at the bottom of our ads.'**

—Jim Robertiello, Omnipoint New York

**DOING UP DIGITAL**

Digital is another major selling point. PCS carriers are leveraging the digital advantage not only for the usual enhanced features, such as paging, voice mail, e-mail, fax mail and guaranteed end-to-end security, but also for more unexpected value-added features. For example, PrimeCo subscribers in Chicago and Milwaukee can receive a weather warning service that broadcasts weather updates to the handset on a regular basis.

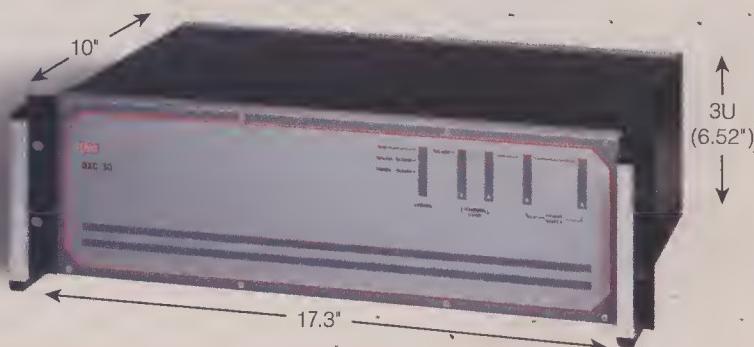
While most PCS carriers say they want to compete on quality more than price, high-end users in particular are finding price benefits to PCS. A CellPak

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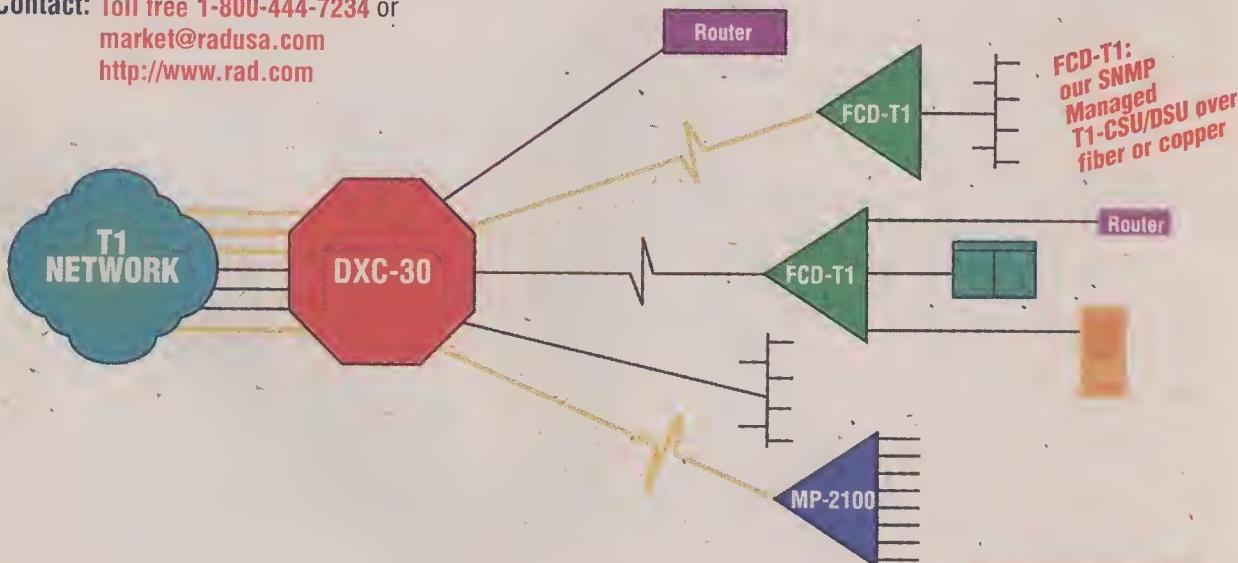


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RAD Data Communications, Inc.

250 package at Cellular One in Chicago costs \$94.95 per month and includes 200 prime and 50 nonprime minutes and call waiting; a 260-minute with AT&T Digital PCS in Chicago costs \$69.99 and includes all the digital features.

"They're trying to lure the 'hot towel group,' the small segment of premium users that fly first-class and generate the most revenues," Fraser says. "PCS carriers are luring those customers with the digital features and lower costs for high-volume users, as well as good roaming agreements and promises of rapidly increasing coverage."

On the flip side, Fraser says, those carriers are hoping that the relatively high price of the phone will scare off the "glove box users"—customers who keep their phones for emergencies only.

"It costs on average \$34.95 a month to keep a customer," she says. "If the customer is on a \$19 a month rate plan, the carrier is losing money. PCS providers want the customers who will actually use the phone."

#### NAME DROPPING

As a last resort, PCS carriers aren't ashamed to take advantage of their parent companies and their solid brand names. AT&T Wireless is selling full suites of AT&T products in its stores, including the WorldNet Internet access service, intraLATA and long-distance services and pre-paid long-distance numbers. The carrier is also providing customers with the option of getting all of their AT&T services on a single bill.

"We're trying to make the relationship with the customer about something more than just wireless," says Jordan Roderick, executive vice president of national operations at AT&T Wireless Services (Kirkland, Wash.). "The idea is to create one total telecommunications shop for our customers."

Similarly, Sprint is counting on its brand name to push sales of its Sprint PCS service. "With our service, people are buying from a name that they trust," the spokesman says. "Sprint's brand name is associated with good customer service and crystal clear voice quality because of fiber optics, and we're extending that brand to digital wireless."

**'We're trying to establish a strong brand image in the minds of our customers, and we've had a lot of success with Primetheus (the PrimeCo mascot).'**

—Tom Saylor, PrimeCo

Even PrimeCo does some leveraging of its parent companies' brand names—AirTouch, Bell Atlantic and US West Media Group—although the carrier is trying to create its own brand, says Tom Saylor, executive director of product management.

"We're trying to establish a strong brand image in the minds of our customers, and we've had a lot of success with Primetheus (the PrimeCo mascot)," Saylor says. "We have a TV spot that identifies us as related to well-known telecom names, but we don't want to lean too much on our parent organization."

It may not need to. With wireless market penetration in the United States at

only around 17% to 18%, there's plenty of the pie to go around. If PCS carriers have their way, not only will that percentage skyrocket over the next few years, but new subscribers will use takes advantage of new network services and use their phones in unprecedented ways.

"We've done everything we can to make this service usage-friendly," Sprint's spokesman says. "PCS is really changing the way people use wireless communications—we're making wireless at parity with wireline service." ■



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SERVICES

# Notebook

## INCUMBENT WIRELESS CARRIERS MUST WAKE UP, STUDY SAYS

Incumbent wireless carriers have done little to establish brand awareness among potential users. This failure to act could prompt new carriers to snatch those customers from the incumbent's grasp, according to a survey conducted by **The Strategis Group** (Washington).

Two-thirds of potential users cannot name a wireless phone carrier in their area, and over half can't name a wireless phone brand. In fact, the study found that 25% of current customers could not identify the brand of their phone, and 25% could not name their service provider.

This is a golden opportunity for PCS providers to carve a niche for themselves, says Kent Olson, a consultant in The Strategis Group's cellular and PCS practice area.

"This gives PCS carriers the opportunity to build a brand, to differentiate their service from that of incumbent cellular carriers," he says. "Because brand awareness and brand allegiance are not terribly strong among current and potential users, winning customers from the cellular incumbents is less of a challenge." PCS providers also are more likely to attract the desirable high-end customers, he notes.

Because analog cellular carriers tend to provide their phones for free or at a nominal cost in exchange for a service contract, they appeal to the "glovebox," or safety-conscious customer, one who signs up for the minimum level of service and uses the phone only under dire circumstances.

"The carrier makes money on airtime," Olson notes. "If the phone is in the glove-

box and isn't being used, it doesn't make any money."

PCS carriers, on the other hand, require their customers to shell out a significant sum of money for their digital phones and offer huge promotional packages with large amounts of bundled minutes—making the service less appealing to casual users.

However, the Strategis study also found that potential users are not willing to pay as much for the phone or the service as current customers. Potential users said they would pay an average of \$17.90 monthly for service and \$37 for the phone, compared to existing users, who pay an average of \$61 monthly for service and \$138 for the phone.

Potential users are also more likely to be younger than current users, have a slightly lower annual income and are less likely to use the phone for business.

SHIRA LEVINE

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- 200 525 Utility
- 300 575 Computer Service Firm/Software Developer or Other Computer/Electronic-Related Industries
- 400 145 Telecommunications Consulting/Engineering Co.
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- 600 152 Telecommunications Equipment Vendor, Reseller, VAR or Distributor
- 700 500 Finance/Investment/Banking
- 800 600 Corporate/Private/Government Telecommunications User
- 900 625 Association
- 1000 400 Other

(please specify)

2. Which of the following services does your co. provide? (Fill in ALL that apply.)

- 11 A Interexchange Carrier/Long-Distance Service Provider
- 12 B Local Exchange Carrier
- 13 C Cellular Carrier
- 14 D PCS Operator
- 15 E Paging & Message
- 16 F Satellite Communications
- 17 G Other Wireless Operator
- 18 H MSD (Two or more Cable TV Systems)
- 19 I Independent Cable TV System
- 20 J Cable TV Contractor/Engineering Firm
- 21 K Other Cable
- 22 L Competitive Access Provider (CAP)
- 23 M Telecommunications Reseller
- 24 N Internet Service Provider/Commercial Online Service Co.
- 25 O Systems Integration/Dutsourcing
- 26 P Other Carrier
- 27 D OTHER

(please specify)

3. Which of the following describes your title classification? (Fill in ONE only.)

- 28 C Technical Mgmt., Engineering VP, Director or Mgr.; Technical VP, Director or Mgr.; Network VP, Director or Mgr.; Plant Mgr.
- 29 C Engineering (Network Designer, Engineer, Technician)
- 30 C Data Communications/Digital/SIS/MIS Mgmt., (Data Communications, Digital, IS/VP, Director or Mgr.)
- 31 C 13 Mgmt., (VP, General Mgr., System Mgr., Mgr., Director, Partner, Executive/Senior VP/Director, Treasurer, CFD, CDD)
- 32 C 3 Corporate Mgmt., (Chairman, Owner, President, Director, Executive/Senior VP/Director, Treasurer, CFD, CDD)
- 33 C 4 Legal, Financial, Regulatory or Processing Services (Director or Mgr. of Rate Planning & Administration, Service Costs, Methods)
- 34 C 5 Personnel & Administrative Services (Director or Mgr. of Training, Safety, Security, Buildings & Land, Supplies & Distribution)
- 35 C 16 Sales/Marketing (Sales or Marketing VP, Director, Mgr., Representative)
- 36 C 20 Purchasing (Purchasing, Materials, Contract VP, Director or Mgr.)
- 37 C 7 Other (Co. Copies and Other Titled and Non-Titled Personnel)

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295	296	297	298	299	300	301	302	303	304	305	306	307

4. Which of the following equipment/services do you purchase, recommend, specify, approve or otherwise influence the purchase of? (Fill in ALL that apply.)

- 38 A Wireless/Cellular/Mobile/PCS Equip./Services
- 39 B Central Office Equip./Services (CD Switching Equip., digital, ATM, Programmable Switches, Operations Support Systems, Workstations, CO Test, Hardware, Frames)
- 40 C Transmission and Broadband Distribution Equip./Services (Digital Loop Carriers, Sonet, T1, Microwave, Satellites, Digital Cross Connects, Amplifiers, Passives, Cable, Long Haul Transmission Systems, Loop Distribution and Electronic Systems, Multiplexers)
- 41 D Cable/Video/Multimedia Equip./Services (Headend Equip., Antennas, Switches, Receivers, Studio Equip., Audio Processors, Fiber/Coax Systems, Network Mgmt., Video Servers, Video Operations Support Systems, Set Top Equip.)
- 42 E Customer Premises, Broadband Subscriber Equip./Services (POTS, Station Equip., ACDs, Videconferencing, Remote Controls, Converters)
- 43 F Outside Plant and Construction Equip./Services (Pedestals, Vehicles, Towers, Tools, Enclosures)
- 44 G Data Communications/MIS/Network Mgmt. Support Equip./Services (including LANs, WANs, & Network Software)
- 45 H Power & Protection
- 46 I Test & Measurement
- 47 J Other (please specify)
- 48 K None of the Above (A-J)

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## THE FLEXIBILITY TO FINE-TUNE

Smart antenna systems have a 12-beam antenna array, allowing CDMA coverage to be adjusted in 30° increments. By contrast, operators using conventional, three-sector antennas can only make adjustments in 120° increments.

Using integrated PC-based software, RF engineers manipulate the antenna's radiation pattern, optimally configuring the system for local traffic patterns, terrain and RF conditions. At three-sector cell sites, the systems enable greater control of per-beam gain, and sector orientation and beamwidth.

RF coverage can be varied in 30° increments by adjusting the transmit gain and receive attenuation of each beam. Per-beam gain control allows RF engineers to sculpt a cell's footprint for optimal coverage and minimum forward and reverse link interference. It can be used to control overshoot, limit handoff activity, or target coverage in specific areas such as high-rise buildings or intersections with high call volumes.

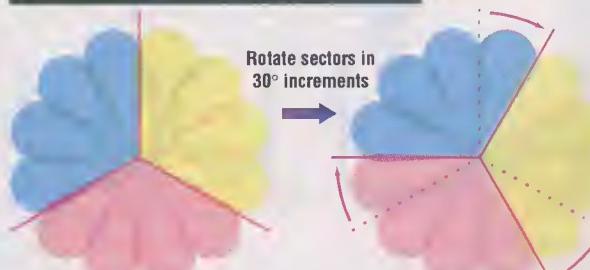
Operators can adjust azimuth (orientation) pointing angles in 30° increments based on traffic patterns and topography. Orientation control enables flexibility for traffic-load leveling. An operator may reorient CDMA sectors to split a high-traffic area between two sectors, reducing sector peak loading.

In heavy handoff areas or for cells on highway corridors, narrow beamwidths may improve performance; in areas with low traffic density, wider beam widths can be effective. RF engineers can adjust sector beam width to match sector capacity requirements and provide greater capacity. A single physical antenna structure can support a large number of different antenna patterns. Technicians can quickly optimize a cell without having to purchase, mount and trial several antennas to determine which one works best. Configuration

forward link, reduces capacity and increases call failure. When conventional, wide-beam antennas are used, cutting back coverage to control pilot pollution can reduce coverage in non-affected areas.

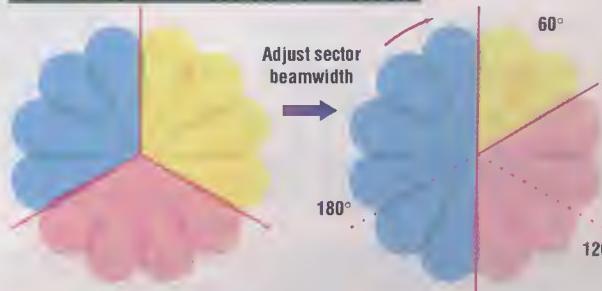
The per-beam gain control on smart antennas controls overshoot by adjusting antenna gain in 30° increments. Orig-

### Orientation



Smart antennas allow operators to orient CDMA sectors based on local terrain and traffic patterns.

### Beamwidth



Operators can use smart antennas to adjust sector beamwidth to match sector capacity requirements.

Source: Metawave



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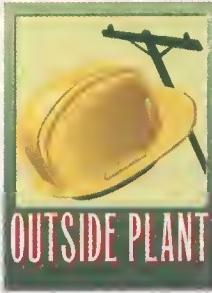


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MARTY FEUERSTEIN

# Controlling RF coverage

## Smart antennas know how to optimize CDMA networks.

**N**ew technologies bring new challenges, as operators deploying code division multiple access (CDMA) networks have learned. Ensuring optimal network performance has required new radio frequency (RF) engineering skills. Optimization is an iterative and time-consuming process.

By giving operators greater control over interference and traffic-load leveling, smart antenna systems allow CDMA networks to be optimized quickly, easily and with better results.

### THE FLEXIBILITY TO FINE-TUNE

Smart antenna systems have a 12-beam antenna array, allowing CDMA coverage to be adjusted in 30° increments. By contrast, operators using conventional, three-sector antennas can only make adjustments in 120° increments.

Using integrated PC-based software, RF engineers manipulate the antenna's radiation pattern, optimally configuring the system for local traffic patterns, terrain and RF conditions. At three-sector cell sites, the systems enable greater control of per-beam gain, and sector orientation and beamwidth.

RF coverage can be varied in 30° increments by adjusting the transmit gain and receive attenuation of each beam. Per-beam gain control allows RF engineers to sculpt a cell's footprint for optimal coverage and minimum forward and reverse link interference. It can be used to control overshoot, limit handoff activity, or target coverage in specific areas such as high-rise buildings or intersections with high call volumes.

Operators can adjust azimuth (orientation) pointing angles in 30° increments based on traffic patterns and topography. Orientation control enables flexibility for traffic-load leveling. An operator may reorient CDMA sectors to split a high-traffic area between two sectors, reducing sector peak loading.

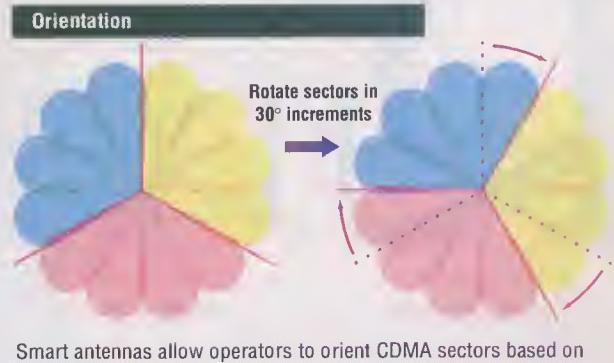
In heavy handoff areas or for cells on highway corridors, narrow beamwidths may improve performance; in areas with low traffic density, wider beam widths can be effective. RF engineers can adjust sector beam width to match sector capacity requirements and provide greater capacity. A single physical antenna structure can support a large number of different antenna patterns. Technicians can quickly optimize a cell without having to purchase, mount and trial several antennas to determine which one works best. Configuration

changes can be made on-demand and from a remote location (such as the switch). Engineers can alter sector configurations based on time of day, day of the week or to accommodate an anticipated one-time increase in call volume.

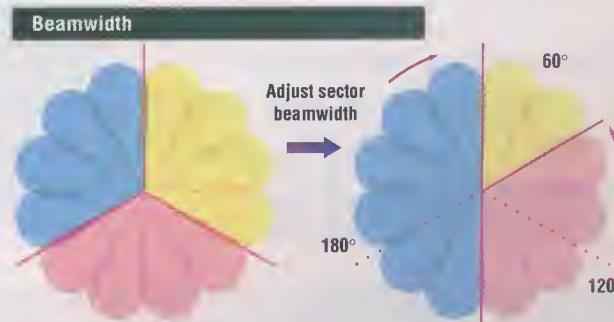
### IMPROVING CDMA PERFORMANCE

Where four or more strong servers are present, mobiles may have a difficult time maintaining connections to the best servers. In addition to poor call originations and terminations, multiway handoff connections can predominate which, because of the additional transmit power they require on the forward link, reduces capacity and increases call failure. When conventional, wide-beam antennas are used, cutting back coverage to control pilot pollution can reduce coverage in non-affected areas.

The per-beam gain control on smart antennas controls overshoot by adjusting antenna gain in 30° increments. Ori-



Smart antennas allow operators to orient CDMA sectors based on local terrain and traffic patterns.



Operators can use smart antennas to adjust sector beamwidth to match sector capacity requirements.

Source: Metawave

nations and terminations are improved and capacity is increased because hand-offs are controlled more tightly. Coverage is reduced only where interference is a problem.

By adjusting the size and/or orientation of cell site sectors, operators can redistribute traffic loads from an overtaxed sector to other sectors where excess capacity goes "unused." By balancing traffic levels among a cell's sectors, operators can optimize existing network resources; they can postpone deployment of another CDMA carrier because capacity provided by the existing carrier(s) is used more efficiently.

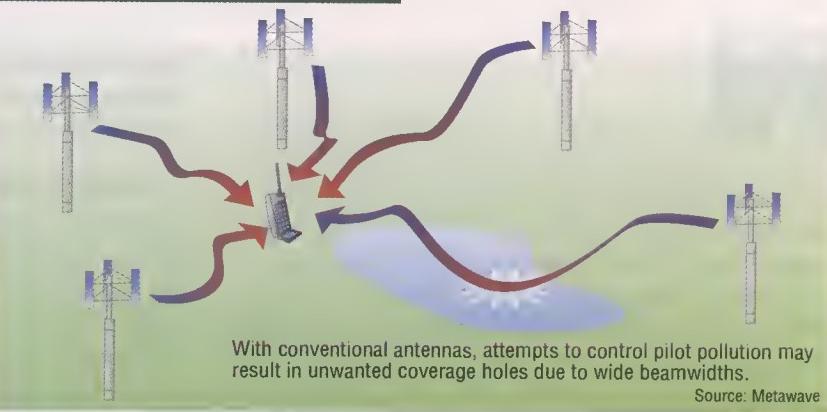
CDMA systems can be difficult to optimize for coverage because the footprint of a CDMA cell expands and contracts as traffic levels fluctuate. Coverage holes can appear and disappear unpredictably, leading to inadequate coverage during peak hours. However, by fine-tuning sector orientation and beamwidth, operators can reduce sector

peak loading by splitting a traffic hot spot previously contained within one sector so that it is served by two instead. A reduction in peak loading improves coverage consistency and safeguards against "dead spots."

When CDMA and analog cell sites share an antenna with the same sector orientation and beamwidth, CDMA performance can be compromised. Analog sectors are configured on a restrictive

grid pattern to facilitate frequency reuse planning, while CDMA sectors can be oriented at any angle because of unity frequency reuse. Using dual-mode smart antennas, operators can use the same physical antenna structure for analog and CDMA, yet configure different sector orientations for each. An operator might reorient CDMA antenna patterns for better load leveling, while leaving the orientation of analog sectors

#### Without smart antennas



Source: Metawave

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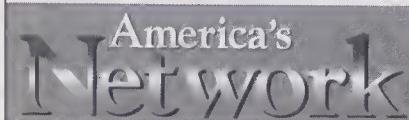
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unchanged. In addition, smart antennas set different sector beamwidths for AMPS and CDMA. In many AMPS networks, wide-sector azimuths are used to accommodate hard handoffs between sectors and cells. For CDMA, smaller sector beamwidths can be used due to softer handoffs. By unlocking the CDMA and AMPS sectors, it's possible to incorporate narrower beamwidth sectors for CDMA while maintaining wider

beamwidths for analog.

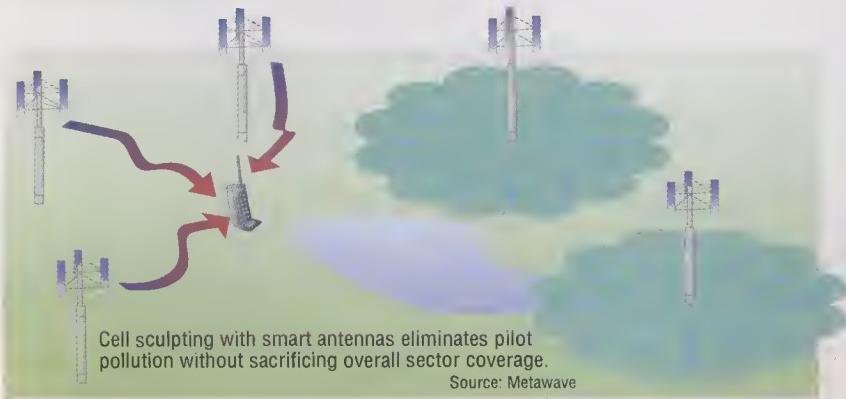
More precise control of interference and RF coverage and an enhanced ability to change antenna patterns lets operators minimize interference, use network resources more efficiently and balance traffic loads. Meanwhile, CDMA networks are "unlocked" from analog systems using the same antenna.

By reducing peak traffic loading, smart antennas extend the capacity of

existing infrastructure. Operators can avoid or delay cell splits, further sectorization or deployment of another CDMA carrier. Traffic is better balanced to compensate for cell "breathing."

Some systems support CDMA and AMPS, offering performance improvements in analog networks, including added capacity, more consistent coverage and better audio clarity. They are a cost-effective solution for spectrum clearing when implementing another CDMA carrier. With single-platform spectrum management, operators can avoid costs, legal hassles and tower-loading concerns with a single antenna structure for AMPS and CDMA without compromising either network. ■

#### With smart antennas



**Marty Feuerstein** is director of research and feasibility at Metawave Communications Corp. (Redmond, Wash.)

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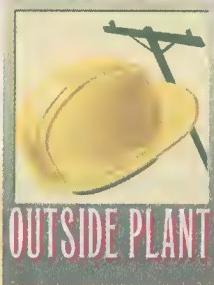


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# Notebook

#### TOLLWAY GETS FIBER SYSTEM

Construction will begin in spring on a 276-mile fiber optic cable and conduit system along the Illinois State Toll Highway Authority's rights-of-way. **MFS Network Technologies Inc.** (Omaha, Neb.), a WorldCom subsidiary, won the contract to design, build and market the network.

In addition to supporting the I-Pass electronic toll collection program, it's expected that the new network will help the authority reduce operating costs, minimize capital investment costs, reduce the impact of utility infringements on the agency's rights of way, and provide access to communications firms, according to Don O'Toole, communications director.

Funds to offset construction costs and provide the agency with a new revenue source will be generated by leasing excess fiber and conduit capacity. MFS will market capacity dark fiber or conduit to local exchange carriers, competitive access providers, cable television operators and wireless service providers.

## **MANUFACTURER STIRRINGS**

- **Galileo Corp.** (Sturbridge, Mass.) has bought **OFC Corp.** (Natick, Mass.) for about \$6 million cash and 1.15 million shares of outstanding Galileo common stock. OFC designs, manufactures and markets optical components and systems, including optical filters, laser systems and analytical instruments. Galileo makes fiber optic and electro-optic products for the medical and telecom sectors.
  - Fiber optic conduit supplier **Pyramid Industries Inc.** (Erie, Pa.) has acquired the power systems business of ETPS Inc. The new division, **Pyramid Power Systems** (Erie), supplies switchmode power products, system controllers and self-contained small power systems.
  - **Belden Wire & Cable Co.** (Richmond, Ind.) formed a North American Fiber Optic Product Group dedicated to developing, manufacturing and marketing an expanded line of tight buffer and loose-tube fiber optic cabling. Belden has consolidated its fiber cable manufacturing operations from its Tomkinsville, Ky. facility into the former **Independent Cable Inc.** plant in Charlotte, N.C. Belden plans to build a fiber optic and specialty cable manufacturing facility in South Carolina. Sales will continue to be handled by Belden's existing sales force.
  - **Fiber Optic Network Solutions (FONS) Corp.** (Northboro, Mass.) formed a joint venture with optical laser manufacturer **Coherent Inc.** (Santa Clara, Calif.). **CFX Communications Systems** will develop and market high-powered broadband transmission products for CATV and Internet access. Products will support hybrid fiber-coax, fiber-to-the-curb and fiber-to-the-home systems.
  - Computer Products Inc., the parent company of **Heurikon** (Madison, Wis.) has merged with **Zytec Corp.** (Minneapolis), giving Heurikon a new name: **Artesyn Technologies**. Artesyn's power conversion product business comprises computer products, Zytec and Elba, a European power conversion company. The former Heurikon, now Artesyn's Communications Products Group, supplies SS7 engines, system controllers and T1/E1 spans.

The network will be constructed in eight phases, beginning with the tollway leg of Interstate 294 that runs from the Wisconsin-Illinois state line south to I-90, and eventually encompassing portions of Interstates 90, 355 and 88. Similar projects include a network along 524 miles of New York's state superhighway system and an 82-mile net in the San Francisco Bay Area.

## CALLBACK FIRM BUYS E1 LINK

**International Telecom** (Seattle) has purchased an E1 link on the Cantat-3 submarine cable from **Teleglobe International**.

This gives International Telecom a direct fiber connection between its Nortel DMS-250 switches in New York and London. The London switch will be a European hub.

"Owning network resources along certain routes is more economical than leasing," states Michael Tyler, director of network planning. International Telecom provides international callback as well as e-mail-to-fax and broadcast fax services.

MARY SLEPICKA

## NEPTUNE LAUNCHING RINGED TRANS PACIFIC CABLE SYSTEM

**Neptune Communications Corp.** (Fairfax, Va.) will develop, build and implement the Pacific Express Cable Network, connecting the U.S. Pacific Northwest to cable landing points in Oahu (Hawaii), Guam, Japan, Korea and Canada in a self-healing ring configuration.

The 25,000 km. submarine cable network will be a four-fiber pair cable system with 80 Gbps of design capacity.

The project is aided by Neptune's recent acquisition of **Pacific Telecom Cable Inc.** (PTC) and **Pacific Telecom Transmission Services Inc.** for about \$70 million. PTC is the U.S. owner, operator and FCC licensee of the North Pacific Cable, a joint undersea cable project with **International Digital Communications Inc.** of Japan and **Cable 8 Wireless plc** of the UK. North Pacific Cable, which began operating in 1991, connects Pacific City, Ore. (the only non-AT&T cable station on the U.S. West Coast), to Muira, Japan and Seward, Alaska.

The system will be implemented in phases, beginning in first quarter 1999 and completing one year later. China is expected to be added to the network in later stages, according to Neptune officials.

**360° TO LEASE TOWER SPACE**

**360° Communications** (Chicago) will lease space on many of its cellular towers in an effort to ease pressure on communities to approve new towers for wireless service providers.

"Our cell sites are in place and we can leverage these assets at a time when new service providers are building and existing carriers are expanding," says Dennis Foster, president and CEO.

The company owns and operates more than 1,700 cell sites in 15 states. In addition to wireless providers, 360° will negotiate leases with radio dispatch services, such as police, fire and ambulance. Carriers interested in receiving information can call 360° at 773/399-2345.

# HDSL

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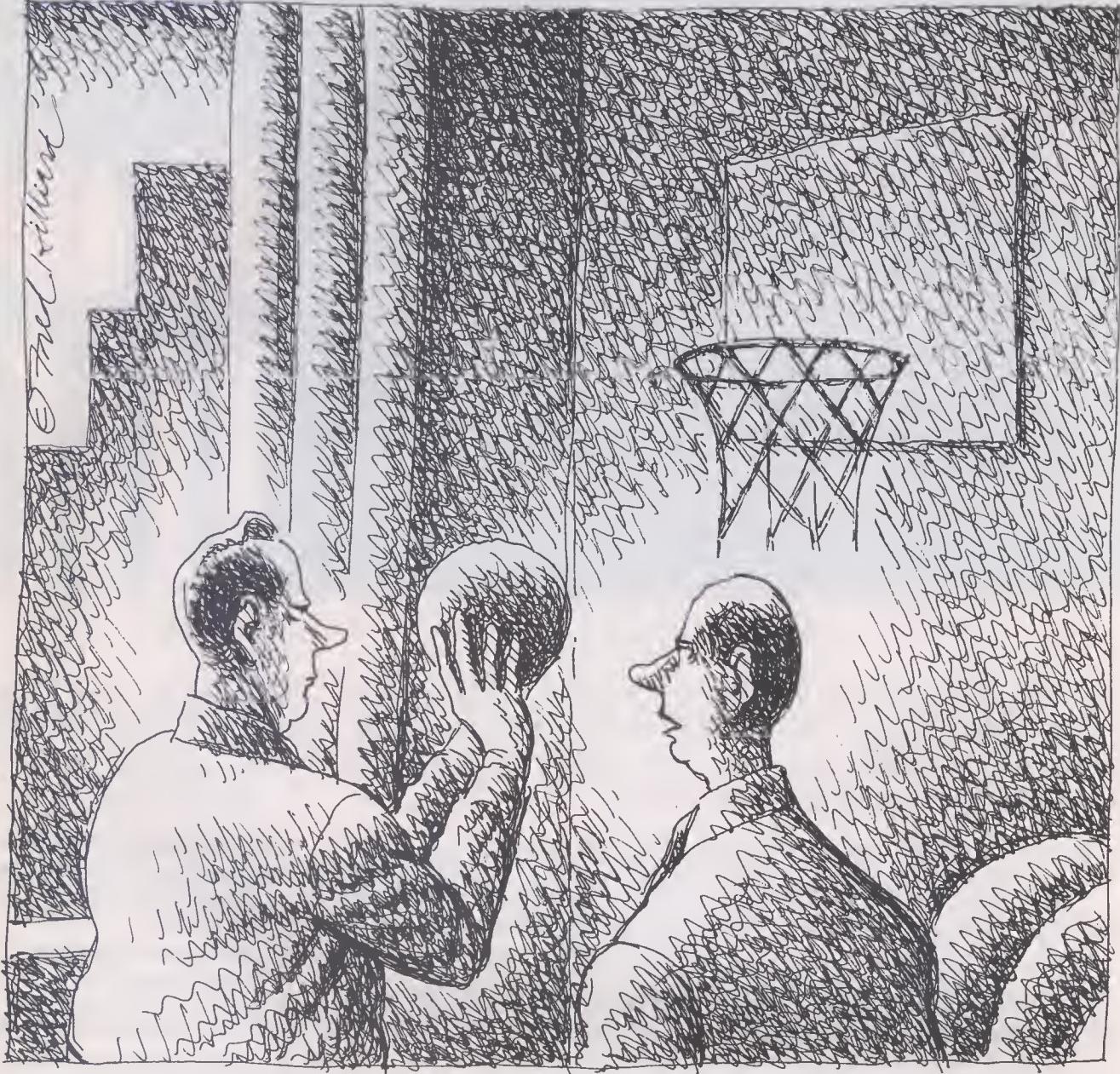
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Circle 114

# WillTales



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DEBBIE L. SKLAR

## Great moments in wireless telephony

In June 1910, a sweeping plan for the extension of the wireless service for the United States Navy was submitted to Congress by Rear Admiral Cowles, chief of the bureau of equipment. Cowles advocated that wireless apparatus of the latest type be supplied to all new vessels of the Navy, including destroyers and all auxiliaries, according to an article in *AN's* grand-dad *Telephone Engineer*.

Wireless telephony received its share of consideration, as well as wireless telegraphy. The Navy required a system that would be operative over distances of 100 miles, and remain in adjustment for five minutes at a time. The transmitting equipment included such high-tech-for-the-era as a "Collins revolving oscillation arc lamp," a "high-frequency and high-potential variable tuning inductance transformer" and a "revolving variable condenser."

In fact, the Collins system was a duplicate of that shown at the Alaska-Yukon Pacific Exposition at Seattle. At the exposition the Collins wireless telephone received the gold medal award, conferred by the official electrical jury.

During this same time, a number of wireless companies consolidated under the name of the Continental Wireless Telephone and Telegraph Company. The corporation organized under the laws of New York, with a capital of \$5,000. The plans of the consolidated companies contemplated transcontinental commercial business, as well as the continuance of the marine reports and shipping messages which up to that time, constituted the greater portion of wireless endeavors. The new company then entered into competition with the old wire telegraph companies for commercial and public patronage.



## LIGHTING UP THE NIGHT

An illuminated, 40-foot telecommunications tower was recently raised atop the landmark LaSalle-Wacker Building in Chicago for the first time in December, adding a new dimension to the 67-year-old building that serves as gateway to the city's business district.

The tower was erected to support competitive local exchange carrier WinStar Communications' (Chicago) wireless telecom services. Lighting on the landmark presents the hi-tech structure as a distinctive rose-colored baton. Designed to maintain the art deco architecture of the building, it joins the Sears Tower and other recognizable landmarks as mainstays of the Chicago skyline.

Whether the tower will attract new users to WinStar's local, long-distance and Internet access services remains to be seen.

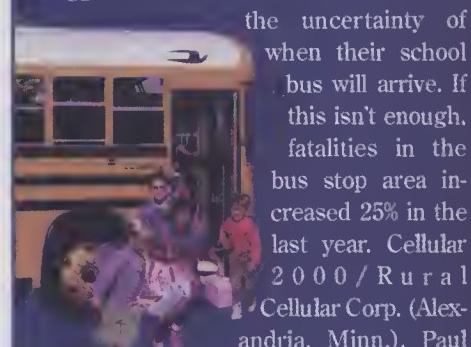


## RECOLL

FROM THE AMERICA'S NETWORK ARCHIVES

## Telephones, buses and keeping kids safe

Each school day, 23 million children ride the nation's single largest transportation network—school buses. These children encounter rain, freezing temperatures, aggressive or inattentive motorists, and



the uncertainty of when their school bus will arrive. If this isn't enough, fatalities in the bus stop area increased 25% in the last year. Cellular 2000 / Rural Cellular Corp. (Alexandria, Minn.), Paul

Bunyan Telephone Company (Bemidji, Minn.) and Global Research Systems Inc. (Rome, Ga.) have arrived at a solution—BusCall.

BusCall is a completely automatic service utilizing Global Positioning System (GPS) satellites for tracking school bus locations. Cellemetry Data Service and spectrum provided by Rural Cellular Corp., allows two-way communication between each school bus and central equipment located at Paul Bunyan Telephone Company. This advanced messaging system includes calling customer telephones, using Internet messaging by sending e-mail, and activating personal pagers when a bus is approaching.

Paul Bunyan Telephone Company is testing BusCall on 10 bus routes north of Bemidji, and plans on offering the product to families throughout the Bemidji School District for the 1998 school year.

The service notifies families when their school bus is approaching their bus stop by ringing their phones with a distinct tone. When answered, the parent or child hears something on the order of: *School bus 44 will be arriving at your bus stop in five minutes and 21 seconds.* This helps families minimize their children's exposure to the outside elements by letting them know exactly when their school bus will be arriving.

What could be next, bus drivers who prepare lunches for their passengers instead of their parents?

DEBBIE SKLAR

# CDMA base stations reduce capital, deployment \$\$\$

The QCell 519e and the QCell 508e base stations for cellular and PCS networks address the needs for compact, lightweight and cost-effective base station transceiver subsystems (BTSs). The Qualcomm systems enable "CDMA one" operators to increase capacity and coverage quickly and easily in environments such as buildings, subways, capacity hot spots, event venues, highways and rural areas, according to the company.

"CDMA base stations can reduce capital and deployment costs by more than 50% compared to macro CDMA



cell sites, while providing operators with additional flexibility in designing mobile and wireless local loop networks," claims John Major, president of Qualcomm's wireless infrastructure products division.

"Furthermore, the QCell 500 series base station will dramatically shorten the deployment process due to the products' small size and wide range of installation options."

The systems are self-contained, lightweight and environmentally designed for indoor and outdoor installations on walls or poles. The BTS weighs 75 lbs. and measures

26" x 15" x 8". Field technicians can install the units by connecting the antenna and backhaul interface, and plugging the product into a universal AC power supply. The base stations' design minimizes costs of obtaining zoning permits and acquiring and preparing sites.

The base stations have 64 channel elements and 10 watts of RF output power. They are configured for omni sector, single RF carrier sites, and can be collocated to provide multiple sector cell design. In addition, the BTSs can be daisy-chained for backhaul, reducing an operator's capital and operating costs.

The remote global position antenna can be installed up to 2,000 feet from the base station, eliminating the requirement for installing coaxial cable to serve tunnels, subways and other hard-to-reach areas. One antenna can be shared by multiple QCell 500 series BTSs.

Microcell and picocell applications can fill in coverage holes or increase capacity in areas where real estate is at a premium. Integral patch antennas for spot and indoor coverage can be pre-installed for public and residential deployments where traditional antenna installation may be blocked. Macrocellular capability allows operators to deploy base stations for wireless local loop service.

*Qualcomm Inc. (San Diego)*

Visit [www.qualcomm.com](http://www.qualcomm.com) or Circle 250

## Wireless Solutions

### Scalable, Internet-enabled messaging

Travelink Messaging and Communications server lets users access and manage voice-mail, fax and e-mail messages from phones, fax machines, cellular phones, Java-enabled browsers and POP3 e-mail clients. The system allows dynamic call forwarding, and has a scalable architecture, which can reduce initial investment. Remote administration can be performed through any Web browser.

The server has built-in intelligence for fault detection and auto recovery. It can send out an emergency pager notification to the administrator when a problem occurs.

Users can listen to e-mail over the phone, using the system's text-to-speech capability. Users are notified by pager when messages are received by the server.

*Spherelink Communications Corp. (San Jose, Calif.)*

Visit [www.spherelink.com](http://www.spherelink.com) or Circle 257

### CDMA multisource generator

The 2026Q multisource signal generator is a fully integrated radio signal receiver for CDMA cellular and PCS handsets.

The unit's two calibrated, combined RF output sources eliminate mechanical RF switching, and additional RF combining or signal conditioning. Thus the CDMA receiver can be tested for sensitivity, in the presence of dual-tone interference and hands-off between radio channels, and between cellular, distributed communications systems (DCS) and PCS bands. Output frequency ranges from 800 MHz to 2.0 GHz, at a combined RF output range of -127 dBm to -13 dBm.

The instrument is a single-box solution for CDMA interference testing in application modes for cellular, DCS and PCS bands for analog, CDMA, time division multiple access (TDMA) and/or GSM subscriber units.

*Marconi Instruments Inc. (Fort Worth, Texas)*

Visit [www.marconi-instruments.com](http://www.marconi-instruments.com) or Circle 254



## Wireless Solutions

*continued*

### Directional control of antennas

Universal T-frame sector mounts provide directional control of cellular and PCS antennas without additional downtilt brackets. The mounts attach to towers with standard 4½" pipemounts. Two adjustable tiebacks assure a rigid and stable mounting system. Antenna spacing is adjusted on the 15-ft. wide, T-frame mounts. Mounting points can be added.

*PiRod Inc. (Plymouth, Ind.)*

Visit [www.pirod.com](http://www.pirod.com) or Circle 251

### Muxed wireless modem

The Rz96003 2.4 GHz ISM-band spread spectrum multiplexed wireless modem uses direct-sequence spread-spectrum technology in the RF section, enabling a transmission rate of up to 2 Mbps. Each modem has one RS-232 (EIA-232) digital port providing a fixed-bit-rate data communication interface.

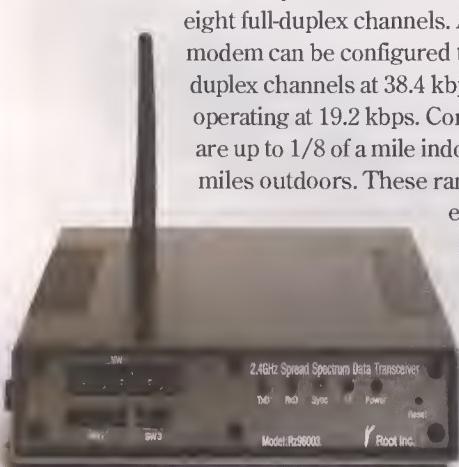
Also, 57.6 kbps of continuous data can be transferred each direction simultaneously when used in the configuration using

eight full-duplex channels. Alternately, the modem can be configured to have up to 13 full-duplex channels at 38.4 kbps or 16 channels operating at 19.2 kbps. Communication ranges are up to 1/8 of a mile indoors and up to 2 miles outdoors. These ranges can be extended

by using the modem in the relay mode; this provides a low-cost, wireless intranet application.

*Root Inc.*

Visit [www.root-hq.com](http://www.root-hq.com) or Circle 256



### Integrated WAN access

The Opera IMux module supports transmission of high-speed data across two to eight T1 and/or E1 lines with combined data rates of up to 15.808 Mbps. The module meets the bandwidth demands of multimegabit and fractional T3 class applications, such as LAN-to-LAN connectivity, image transmission, high-speed data recovery, bulk file transfers and video conferencing.

Error thresholds can be preprogrammed; this triggers a drop of any T1/E1 link when excessive error or signal loss conditions are present. The system adjusts the data rate of the remaining links until the dropped link is restored. A comprehensive menu of diagnostics, including round trip delay measurement, built in bit error rate test and cross detection, are provided.

*Teleprocessing Products (Simi Valley, Calif.)*

Visit [www.teleprocessing.com](http://www.teleprocessing.com) or Circle 261

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## Mobile phone tester

The 4100S portable mobile phone tester for use in service sites and repair depots features asynchronous mode, burst edge failure indicator and remote control using RS-232.

Asynchronous mode lets technicians tune or align mobile phones that are operating in a test mode and transmitting a continuous GMSK signal. The phone can be adjusted to meet GSM specifications with the measurements displayed.

Remote control capability allows the phone tester to be controlled via PC using SCPI command set. Special test routines or interactive programs can be used with the PC. Thus the service site can carry out trend analysis, warranty claims and record statistics for each phone. Programs also can be written for the PC, providing customized test routines, automating more processes, which saves time within a service site.

Failures in the power time template are displayed in the burst edge failure indicator feature. Errors can be identified during the burst rising, constant power or failing time periods.

*Wavetek Corp. (San Diego)*

Visit [www.wavetek.com](http://www.wavetek.com) or Circle 253

## GSM microcellular system

The Turbowave microcellular system offers an integrated, cost-effective solution to enhance wireless service coverage and capacity when deploying GSM microcells.

The unit is available in three configurations: the 4-watt, 8-watt and 16-watt base transceiver stations (BTSs). The unit also meets specific BTS site power requirements of Asian network service providers. Instead of the standard 1-watt microcell transmission power, the customer uses a product of 2-watts of power per radio (scalable to 4 watts) in a two-radio/one antenna configuration. The system can be installed in highly congested and remote, sparsely populated areas.

*Interwave Communications Inc. (Redwood City, Calif.)*

Call 415/482-2100 or Circle 255

## TRAU testing for GSM networks

The SunWareT option SW191 software upgrade for the Sun-set T10 test set enables the tester to support transcoder rate adaptation unit (TRAU) testing for troubleshooting and maintaining new and existing GSM networks. The unit monitors live compressed voice signals, transmits a 13-kilobit voice message or performs a 16-kilobit bit-error-rate test. The T10 also displays activity on all subchannels simultaneously, with a single screen display of TRAU frames detected on each sub-channel as active, idle or data.

The test set combines functions for 1.544 Mbps, ISDN PRI, signaling system 7 (SS7), digital data system (DDS), datacom and voice frequency testing.

*Sunrise Telecom Inc. (San Jose, Calif.)*

Visit [www.sunrisetelecom.com](http://www.sunrisetelecom.com) or Circle 258

## Debit phone programming

The MCS-560 debit phone workstation lets cellular carriers and resellers bypass manufacturers and, instead, program a debit phone on their own.

MCS-560 software generates the necessary programming codes, which tell a cellular phone how and where to work. Codes also make it possible for end users to add additional minutes to a phone by entering a specific code onto the phone's keypad. The software may be installed in a PC using Windows 95. Cellular resellers can supply their own airtime to private-labeled debit phones, and will be able to offer pre-paid or traditional cellular service plans.

*CellTalk Inc.*

Call 212/643-9000 or Circle 260

## GSM triple-band system

The GSM triple-band-capable system operates in the 900, 1800 and 1900 MHz frequency bands using a common physical infrastructure, providing services in areas where people converge—airports, convention centers and large cities. The system provides low transmission costs and can support more than 1,000 transceivers from a single base station controller (BSC).

The small size of the micro and macro base stations means stations in different bands can be deployed on the same site, eliminating difficulties associated with site acquisition and simplifying radio network planning. Collocation of the 900/1800/1900 MHz radio base stations and the implementation of the high-capacity dual- and triple-band BSC lets operators maximize the use of existing transmission networks.

*Ericsson (Stockholm, Sweden)*

Visit [www.ericsson.com](http://www.ericsson.com) or Circle 259

## RF integrated circuitry

With RF integrated circuits (ICs), Texas Instruments' Wireless Communications Business Unit can provide major system blocks for digital cellular, PCS and digital cordless phone applications. RF products for wireless handsets will perform each of the major RF functions within wireless handsets, including receiver, synthesizer, modulator, and power amplifier. Established wireless systems, and mixed-signal or analog will result in RF portfolio development achieving RF function partitioning and integration. As a result, wireless systems can be smaller, more lightweight and less expensive, yet provide longer talk times and standby times from a single battery charge.

The platform provides the framework to ensure that RF ICs and baseband solutions are architecturally matched, thereby reducing power consumption, chip count and system complexity. The resulting simplified designs enable wireless system original equipment manufacturers (OEMs) to shorten their time-to-market. For additional design flexibility, the RF devices also support non-Texas Instruments baseband components.

*Texas Instruments (Dallas)*

Visit [www.ti.com/sc/docs/wireless/home.htm](http://www.ti.com/sc/docs/wireless/home.htm) or Circle 252

## Products and Services

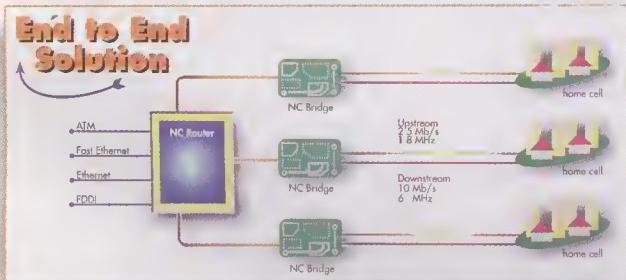
### High-speed data over CATV

The Nemo cable modem provides high-speed Internet surfing over the CATV. The cable's end-to-end solution is comprised of the Netgame bridge and the Nemo cable modem. The product transforms the CATV network into a virtual LAN allowing inter-subscriber communication.

CATV subscribers benefit from high data exchange rates, allowing large files with graphical content to be moved at speeds of up to 10 Mbps. In addition to Internet connectivity, the system supports applications requiring cost-effective, high data transfer. This enables homes, schools, hotels, businesses and municipal governments to be interconnected, as part of an intranet or the global Internet.

*NetGame Cable (Givatayim, Israel)*

Call 415/773-5359 or Circle 262



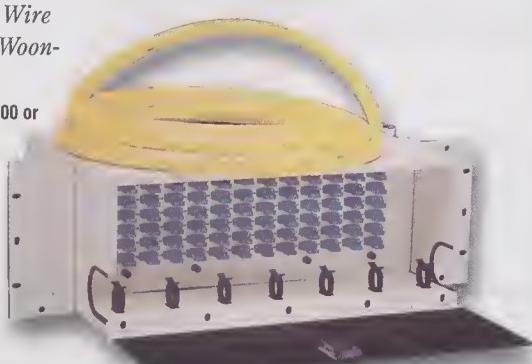
### Preterminated rack mount shelves

Fiber optic rack-mountable pretermination shelves are mountable in any standard 19" or 23" frame.

The shelves are available from 12 to 96 ports using single-mode or multimode cable. Atis connector systems include SC, SC/APC, FC, FC/APC or ST. Backreflection measurements of -55dB or better are guaranteed on all flat connectors and -65dB or better on angled connectors.

*Adirondack Wire and Cable (Woonsocket, R.I.)*

Call 401/769-1600 or  
Circle 266



New product information should be submitted to Debbie Sklar, Solutions editor, at *America's Network*:

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## Itinerary

Date	Event	Organizer/Sponsor	Location	For Information
<b>Feb. 15-19</b>	<b>NTCA Annual Meeting &amp; Expo</b>	<b>National Telephone Cooperative Assn.</b>	<b>Atlanta</b>	<b>202/298-2328</b>
Feb. 15-20	IEEE/IFIP 1998 Network Operations and Management Symposium	CNOM/IFIP	New Orleans	212/705-7865
<b>Feb. 15-20</b>	<b>Implementation Conference</b>	<b>The Data Warehousing Institute</b>	<b>San Diego</b>	<b>972/578-5022</b>
Feb. 18-20	Louisiana: Annual Convention	Louisiana Telephone Assn.	New Orleans	504/927-1377
<b>Feb. 22-23</b>	<b>Federal Telecommunications Conference</b>	<b>TeleStrategies/Warren H. Suss Associates</b>	<b>Washington</b>	<b>703/734-7050</b>
Feb. 22-27	Optical Fiber Communication Conference and Exhibit	Optical Society of America/IEEE	San Jose, Calif.	202/223-0920
<b>Feb. 23-25</b>	<b>Wireless '98</b>	<b>Cellular Telecommunications Industry Assn.</b>	<b>Atlanta</b>	<b>800/424-5249</b>
Feb. 24-25	Performance Indicators & Benchmarking	Institute for International Research	Key Biscayne, Fla.	888/670-8200
<b>Feb. 24-27</b>	<b>Comdex Mexico</b>	<b>E. J. Krause &amp; Assoc. Inc.</b>	<b>Mexico City</b>	<b>301/493-5500</b>
Feb. 25-26	IMT 2000 Wider Band CDMA Conference	Wireless Institute of Technology	Atlanta	510/490-6459
<b>March 3-6</b>	<b>Global TMN Summit</b>	<b>Vertel</b>	<b>Orlando, Fla.</b>	<b>818/227-1424</b>
March 9-10	New Directions in SS7	TeleStrategies	Washington	703/734-7050
<b>March 9-13</b>	<b>Internet World 98</b>	<b>Mecklermedia</b>	<b>Los Angeles</b>	<b>800/632-5537</b>
March 10-12	Telecom Business/TeleCard World	MultiMedia Publishing Corp.	Dallas	713/974-5252
<b>March 15-18</b>	<b>WRTA Convention</b>	<b>Western Rural Telephone Assn.</b>	<b>Las Vegas</b>	<b>707/538-7755</b>
March 16-18	Customer Care Conference	Institute for International Research	Coconut Grove, Fla.	888/670-8200
<b>March 22-25</b>	<b>MTA Annual Convention</b>	<b>Minnesota Telephone Assn.</b>	<b>Minneapolis</b>	<b>612/291-7311</b>
March 23-25	Calling Party Pays	Institute for International Research	San Francisco	888/670-8200
<b>March 24-27</b>	<b>Carolinas, Virginia: Spring Meeting</b>	<b>Carolinas-Virginia Membership Assn.</b>	<b>Williamsburg, Va.</b>	<b>910/592-5751</b>
March 30-April 2	InterComm '98	Telecommunications Industry Assn.	Toronto	703/907-7700
<b>March 31-April 3 Telexpo '98</b>		<b>Telecommunications Industry Assn.</b>	<b>São Paulo, Brazil</b>	<b>703/907-7700</b>
April 1-2	North Dakota: Annual Meeting	North Dakota Telephone Assn.	Bismarck, N.D.	701/223-6022
<b>April 15-17</b>	<b>TeleCon East</b>	<b>United States Distance Learning Assn./GE Spacenet</b>	<b>Washington</b>	<b>800/829-3400</b>
April 20-23	Expo Comm USA/Comdex/Windows World	E. J. Krause & Assoc. Inc./ZD Comdex & Forums	Chicago	301/493-5500
<b>April 21-23</b>	<b>TeleManagement World</b>	<b>NMP</b>	<b>Paris</b>	<b>973/425-1900</b>
April 27-29	Voice+Internet Conference & Exhibition/Internet & Electronic Commerce Conference	Advanstar Communications Call Center/Voice Group/IEC	New York	800/265-5665
<b>April 28-May 1</b>	<b>Communications '98</b>	<b>E. J. Krause &amp; Assoc. Inc.</b>	<b>Beijing</b>	<b>301/493-5500</b>
May 3-6	Cable '98	National Cable Television Assn.	Atlanta	202/775-3669
<b>May 12-16</b>	<b>Sviaz/Expo Comm Moscow</b>	<b>E.J. Krause &amp; Assoc. Inc.</b>	<b>Moscow</b>	<b>301/493-5000</b>
May 19-22	CTI Expo Spring '98	CTI Expo	Baltimore	203/852-6800

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Conference Interest:  ICA  IEC  IEEE  
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ALAN PEARCE

# Federal face-saver

## AT&T/TCG deal may fare well in Washington.

**T**he beat goes on. This is not meant as my final tribute to the late Sonny Bono (R-Calif.), but refers to the merger-mania that continues to grip the industry.

You may think that mergers are old hat; but I can tell you, without equivocation, that they will continue to plague public policymakers as the industry careens toward the millennium.

After a spate of mergers (Last Call, Dec. 15, 1997), the one that deserves particular attention now is AT&T's planned acquisition of Teleport Communications Group (TCG) for about \$11.3 billion. This will get close (and, most likely, sympathetic) attention at the Department of Justice (DOJ) and the FCC for several reasons:

- For the first time since the Bell System breakup, AT&T appears ready, willing and able to re-enter the local wired service market, competing with the regional Bell operating companies (RBOCs) and other incumbent local exchange carriers (ILECs), at least for business customers.
- This is the first acquisition under the leadership of AT&T's new chairman and CEO, Michael Armstrong, who was recruited from outside mainstream telecommunications to help create a stronger, more focused, competitive, customer-friendly and relevant firm. Consequently, much is expected from Armstrong; he must prepare AT&T for serving business in complex global and domestic environments.
- The merger may be the break that the federal policymaking establishment has been praying for. With anxious politicians breathing down the DOJ's and FCC's necks, and asking why little, if any, added competition has emerged in since the 1996 passage of the Telecommunications Act, Washington now has a powerful reason for finally allowing the RBOCs to enter the long-haul market: policymakers can point to a major global telecommunications company that wants to make local services competitive.
- Once the RBOCs are given the go-ahead, another wave of megamergers will erupt as Ameritech, Bell Atlantic-Nynex, BellSouth, SBC/PacTel and U S West are free to acquire and/or merge with other global carriers. This poses a somewhat longer term problem for the DOJ and FCC—namely, how the industry will be structured and what political, public

**The DOJ and FCC now have a powerful reason for allowing the RBOCs to enter the long-haul market.**

appointed Republican commissioner who moved from the DOJ's antitrust division to the FCC a couple of months ago, suggests that the time is right to allow the RBOCs to compete; at the very least, he says, the FCC should significantly reduce its current "rules" for long-haul entry.

### AND NOW, THE CONDITIONS

The AT&T-TCG deal is not necessarily a slam-dunk. There will be imposed conditions; for example, AT&T may have to assure policymakers that TCG will continue to serve some of AT&T's traditional long-haul competitors (MCI and Sprint, for example, and existing and potential local exchange competitors).

TCG recently announced its intention to enter domestic and international long-haul services, and is using a variety of non-AT&T allies as part of its entry strategy. Policymakers would not like it if AT&T arbitrarily—and unilaterally—terminated those plans. It would be wise if AT&T allowed TCG to continue to act somewhat independently, giving it the flexibility to work not just with its new parent but with any entity that can help it expand its presence.

TCG has done well on its own. Indeed, AT&T has been a good customer of TCG, but by no means the only one. Clearly, there are some vital business and public policy synergies underway; but if this deal is to pay off for all parties (the two companies, the competitors, the policymakers and the public), AT&T should continue to permit TCG to do what it has been doing so successfully for the past 10 years—serve all customers equally.

If Armstrong is able to convince his top managers to do just that, then his 'new' AT&T will begin to show signs that it is truly ready for the pro-consumer, competitive age that was promised in the Telecom Act—a promise that, as yet, remains undelivered. ■

Alan Pearce is president of Information Age Economics Inc. (Washington). He can be reached at 202/466-2654.

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